AUGUST 15, 1947

Engineering Library

AUTOMOTIVE INDUSTRIES

The Industrial News Authority Devoted to Automotive Products for Land, Air & Water

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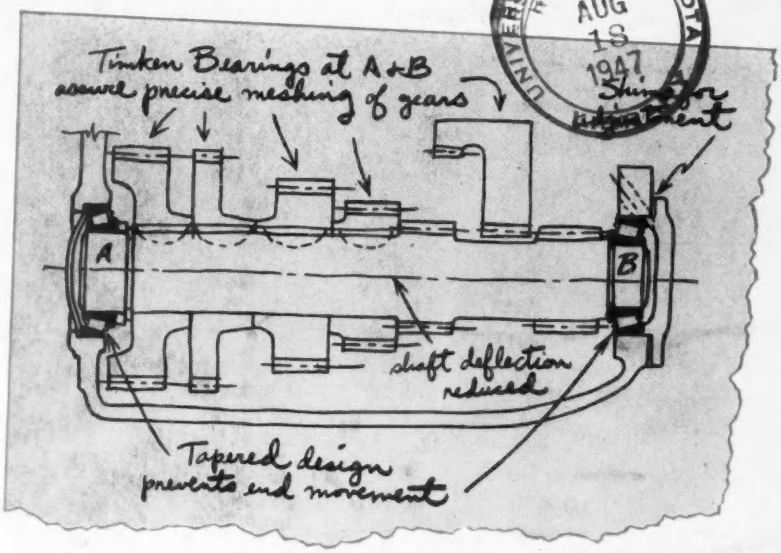
One way to get added precision in your automatic transmissions

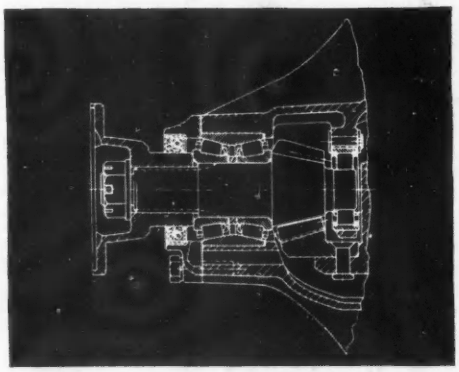


OOK at the Timken bearing at the lower right. Note the tapered conuction, the line contact between rolls d races. That's the basic reason why mken bearings can help give you preion meshing and trouble-free performce in your automatic transmission.

Because the tapered design takes thrust well as radial loads, end-movement of e shaft is eliminated.

And due to the line contact between lls and races, Timken bearings offer u maximum load carrying capacity. here's no chance for shaft deflection or salignment of gears. The result is noother transmission performance, nger life.

LOOK AT STRADDLE PINIONS FOR EXAMPLE... Double cup bearing is mounted directly into the axle housing and shims are pro-



vided between the face of the double cup and shoulder in the housing for the proper gear setting. Here, and in scores of other automotive applications, Timken tapered roller bearings have proved their ability to retain precision.

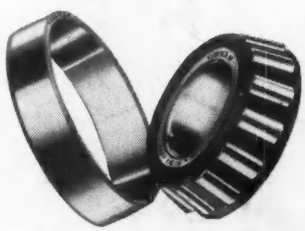
Timken bearings normally outwear the car itself. And you're always sure of precision performance because Timken is the acknowledged leader in 1. advanced design, 2. precision manufacture, 3. rigid quality control, and 4. special analysis steels. If you are designing an automatic transmission, let us show you how Timken bearings can help make it better. In Detroit, phone MAdison 1380. The Timken Roller Bearing Company, Canton 6, Ohio.

NOTE TO P. A.'s. *Because every step of the manufacture of Timken bearings is controlled within our company . . . because our vast manufacturing facilities are widely dispersed . . . you will find the Timken Company a supply source of outstanding reliability.*

TIMKEN

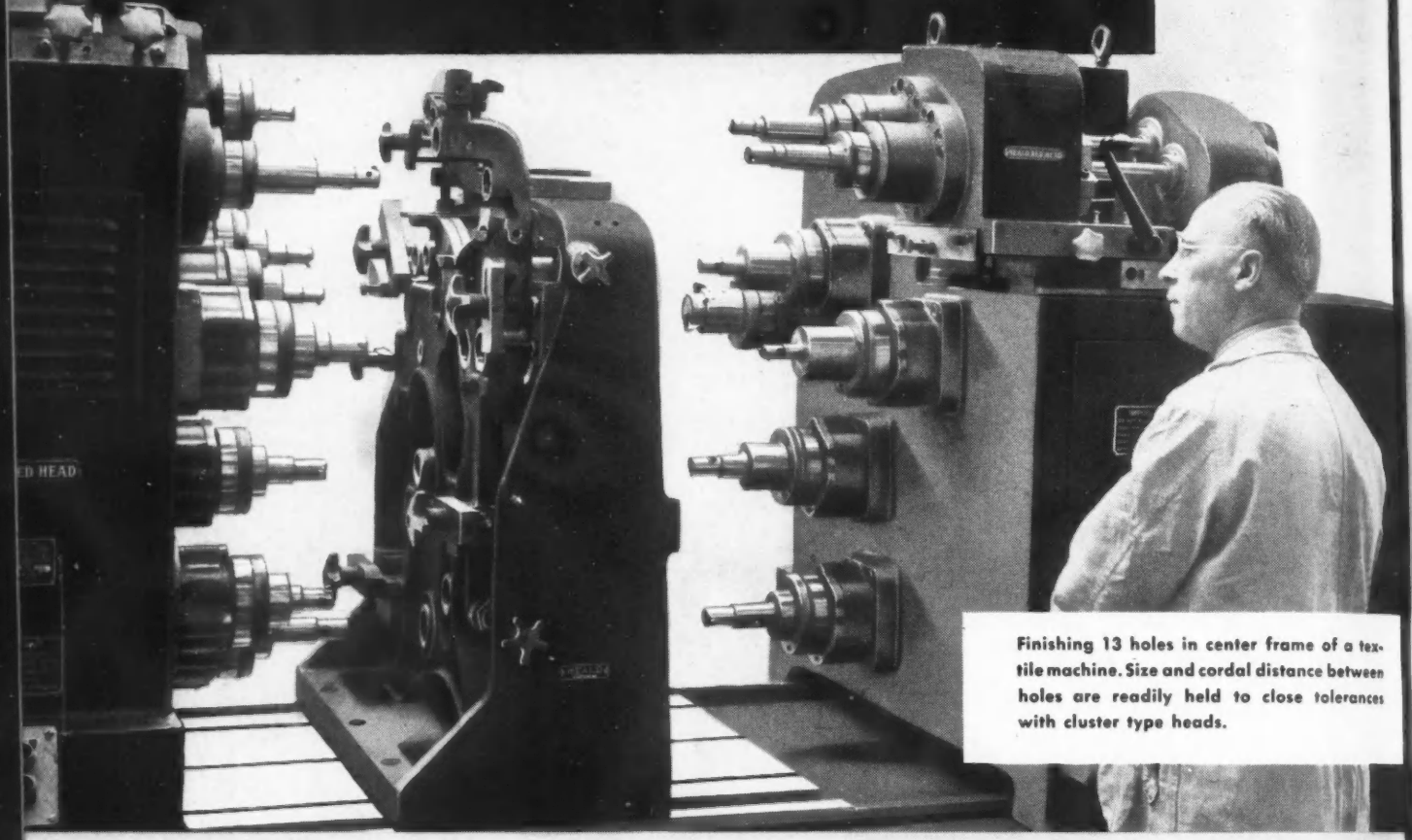
TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ◯ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◎ AND THRUST →◎← LOADS OR ANY COMBINATION →✳←

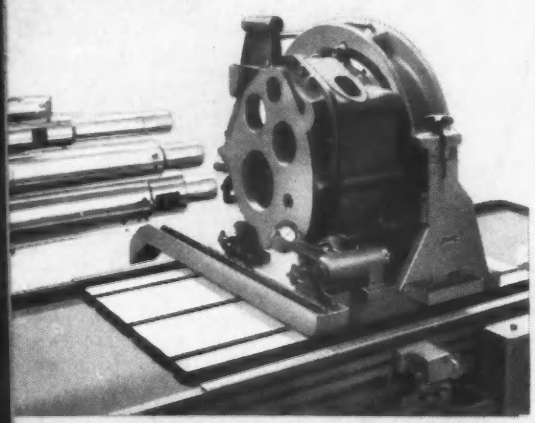
FOR MULTIPLE-BORING OF LARGE, AWKWARD WORK...



Finishing 13 holes in center frame of a textile machine. Size and cordal distance between holes are readily held to close tolerances with cluster type heads.

The Heald No. 45 Bore-Matic is the ideal machine

Boring, chamfering and grooving multiple holes in a transmission case assembly. Note accuracy gauge below work to assist operator.



AVAILABLE EITHER as a single or double-end machine—and with as many as 15 boring heads—the Heald No. 45 Bore-Matic is designed specifically for boring large, hard-to-handle work.

Built low to the floor for the greatest possible convenience in loading, it permits great accuracy in boring heavy cylinder blocks, pump and compressor bodies, large connecting rods, and the like. It can handle parts with holes up to 9" in diameter or with center-to-center distance of finished surfaces up to 33½". Where the part has opposing holes, the double end machine assures extremely accurate alignment.

If you have large, heavy parts that must be machined to close tolerances, be sure to get all the facts on the No. 45 Bore-Matic. Get in touch with the Heald branch office nearest you, or write: THE HEALD MACHINE COMPANY, Worcester 6, Mass.

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AUTOMOTIVE INDUSTRIES

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● Turning passenger loads into "pay-loads" is the job of the new Intercity Bus, Model W-1, made by the Bus Division of the Kenworth Motor Truck Corporation, Seattle, Washington. Young is proud to be a contributor to this new bus, just introduced to the public as the latest addition to the Kenworth line. The Young heavy-duty, bus type radiator, used to cool the Model W-1 represents the combination of engineering experience and manufacturing skill which Young Heat Transfer Specialists apply to every cooling problem. The result—equipment that does the job faithfully and economically because it was designed to do just that.

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WORLD'S LARGEST INDEPENDENT AUTOMOTIVE PARTS PLANT

AUTOMOTIVE INDUSTRIES

Published on the first and 15th of the month

August 15, 1947
Volume 97, No. 4

Some High Spots of this Issue

Chevrolet's Ultramodern Plant

Incorporating advanced concepts in industrial design and mass production equipment, this new plant on the outskirts of Flint, Mich., is actually a three-in-one unit—housing passengar car assembly, Fisher Body assembly, and truck assembly, including truck body fabrication. Over 3½ miles of conveyor lines help to speed passenger car and truck production. A description of the production highlights at this plant begins on page 24.

Only Skeleton of Prewar German Automobile Industry Left

What happens to a loser of a modern war is shown clearly by the current condition of the German automobile industry. Capable of making over 1.6 million motor vehicles annually before the war, now it can produce only at the annual rate of a little over 40,000 units. Based on registration of vehicles, Germany is back where she was in 1928. The problems in that nation and the economic crisis that has been generated by nationalization of industries in Czechoslovakia are presented on pages 28 and 29.

Extrusion Process Applied to Metal Powder Gears

By applying the extrusion process to the manufacture of metal power parts, Ford Motor Co. has developed a method for producing oil pump gears at lower cost and to closer tolerances. Details of this new method are given on page 30.

International-Continental Engine for Hauling Heavy Loads over Mountain Roads

Designed primarily for operations in the Rocky Mountain and Pacific Coast sections, the Continental-built engine in International Western model trucks has a displacement of 749 cu in. and develops 246 hp. It is equipped with cylinder bore liners, seven bearing crankshaft, five-ring aluminum alloy pistons, Silchrome intake valves, sodium-cooled exhaust valves with Stellite faces and fitted with Roto-Valve mechanism, Stellite-faced exhaust valve seats, and dual valve springs. For specifications and performance curves, see page 42.

What Is the Actual Demand for Cars?

If you are interested in the demand for passenger cars, both new and used, you will want to study the results of the consumer survey sponsored by the Federal Reserve Board. It starts on page 44.

21 New Production Equipment and New Product Items And Other High Spots Such As:

Special purpose machinery in use at the Spicer plant; constructional details of the Farmall Cub tractor; an analysis of epicyclic gear systems with respect to gear speeds, torque and tooth loads; innovations in the Tucker car; comprehensive presentation of helicopter engine problems; and what Britain is doing to regain her export trade to South America.

Comprehensive Interpretation of Industry News, Page 17

For Complete Table of Contents, See Page 3

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Manufacturer Flies Ryerson Engineer to Plant . . .

and returns him with problem solved

A machinery manufacturer faced an emergency. He was changing over to flame-cut steel plate for many parts previously cast. In the process of change-over, unforseen production problems threatened to stall his entire operation. Committed to a heavy schedule of deliveries, he saw the threat of reduced volume as an inconvenience to customers—a mark against his company.

Moving swiftly against time, he called Ryerson in a neighboring state, offering to send his company plane if a Ryerson specialist would make a flying trip to his plant. We agreed, and, in a matter of hours, a Ryerson engineer was on the spot giving practical assistance.

By simplifying several parts, engineering difficulties were avoided. Standardization of other parts reduced cost and made better use of available steel. There was no slow-down in production.

As our specialist was flown back that same day, he made out a report covering his activities. It was brief enough. It read: Customer service.

That brief report—customer service—sums up the reason so many steel users make Ryerson the first source for steel from stock and turn to us in time of trouble. Despite steel shortages there is no shortage in our willingness and ability to cooperate. Our technical men will gladly work with you on any steel problem, or assist in the search for a suitable alternate when needed steel is not available.

Remember that Ryerson facilities and experience are always at your service when you call.

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RYERSON STEEL

Vol. 97, No. 4

NEWS of the AUTOMOTIVE INDUSTRIES

August 15, 1947

GM Reports 1st Half '47, Net Income, $147.6 Million

General Motors Corp. reported a most encouraging first six months as contrasted with the same period in 1946, with net sales of $1,746,421,483 and net income of $147,622,834. In the first six months of 1946, GM had net sales of $492,260,800 and a net loss of $19,804,090, after effecting U. S. tax credit adjustments of $81,330,000. In the second quarter of 1947, GM net sales totaled $941,568,274, and net income amounted to $81,804,815, as against net sales of $417,310,182 and net income of $16,320,573, after credit adjustments for U. S. income and excess profits taxes of $28,466,000, for the second quarter of 1946.

GM points out, however, that as in the first quarter of 1947, sales of products other than cars and trucks, such as service parts, household appliances, Diesel engines and locomotives were high in proportion to total sales. A total of 924,032 cars and trucks, including export shipments from GM plants in the U. S. and Canada were sold to dealers in the first six months of 1947, as against 257,371 in the first half of 1946. The second quarter of 1947 accounted for 473,805 cars and trucks sold to dealers and shipped for export from GM plants in the U. S. and Canada, which compares with 254,382 units in the same period of 1946.

Packard Raises Prices; $1.8 Million Net Loss

In view of a net loss of $1,872,634 for the first half of this year, and recent basic materials cost increases, Packard Motor Car Co. has announced a five per cent average price increase, ranging from $92 to $200 a car, on all models. The net loss for the second quarter of this year was $724,461, although production was 10 per cent higher than in the first quarter. Packard produced 24,053 automobiles in the first six months of 1947. George T. Christopher, president, pointed out that an additional tool cost write-off of about $1 million for the new 1948 model convertible and a new model soon to be introduced was included in this report.

Independents Increase Share of Car Market

Reversing a sales trend in recent years, the independent car manufacturers in the past 18 months have captured the best share of the automobile market that they have had since 1931. In 1931, of total factory sales of cars in the U. S. of 1,973,090, Hudson, Studebaker, Willys, Packard and Nash accounted for 18.8%. According to Ward's Automotive Reports, in 1946 these independents together with Kaiser-Frazer produced 15.4% of the country's automobiles, and in the first six months of 1947, they made 16.1%. This picture today is contrasted with 9.9% in 1941. Production figures are used since 1937 because factory sales totals are not available by makes.

Standard's Export Bid—Vanguard 1948

Not to be produced by the Standard Motor Co. Ltd. until 1948, the first six months' output of this 1948 Vanguard has been earmarked for export. Featuring an independent coil spring front suspension and a hypoid rear axle, the new car will comfortably seat six persons. The new Vanguard will replace Standard's eight, 12 and 14 hp models, and will be sold in overseas markets. Acme photo

Motor Vehicle Factory Sales from U. S. Plants*

	Passenger Cars	Trucks	Buses	Totals 1947	Totals 1946	Totals 1941
January	246,605	99,818	1,273	347,696	101,867	499,448
February	267,015	105,042	1,303	373,360	93,042	484,891
March	301,525	118,234	1,421	421,180	124,003	510,122
April	314,765	106,984	1,650	423,399	214,350	464,301
May	284,357	96,430	1,853	382,640	243,104	518,746
June	305,943	93,981	1,628	401,552	201,902	520,892
Total—Six Months	1,720,210	620,489	9,128	2,349,827	978,268	2,998,400

FACTORY SALES TO DOMESTIC AND FOREIGN MARKETS

	Passenger Cars		Trucks		Buses	
	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
January	226,695	19,910	77,434	22,384	1,115	158
February	245,081	21,934	83,276	21,766	1,090	213
March	280,018	21,507	92,082	26,152	1,272	149
April	291,953	22,812	83,515	23,469	1,465	185
May	261,240	23,117	75,696	20,734	1,599	254
June	281,867	24,076	73,693	20,288	1,409	219
Total—Six Months	1,586,854	133,356	485,696	134,793	7,950	1,178

* Automobile Manufacturers Association.

Ford has climbed aboard this increased market bandwagon too, jumping from an 18.5% share of production in 1941 to 21.2% for the first six months of 1947. Chrysler's output declined from 23.2% in 1941 to 21.4% of the country's output for the first half of this year, and General Motors slid from 48.3% of the cars produced in 1941 to 41.3% for the first six months of 1947.

GM Increases Prices of Cars and Trucks 2% to 6%

Increased labor and materials costs has forced General Motors Corp. to increase the prices of Cadillac, Buick, Oldsmobile, Pontiac and Chevrolet passenger cars and Chevrolet trucks from two per cent to six per cent, effective Aug. 1. Non-automotive product price adjustments will follow the car and truck pattern, but no general price increase is expected for automotive service parts.

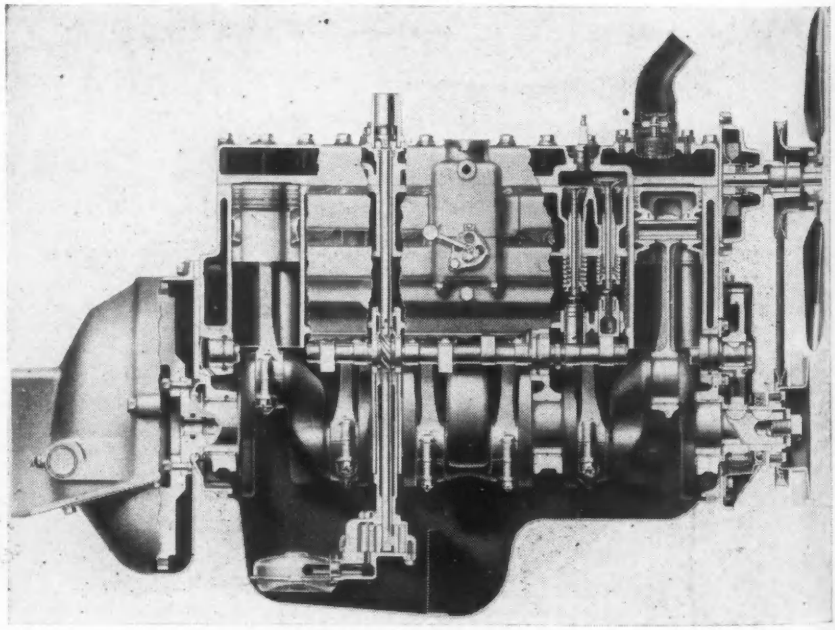
The general increase in GM car prices followed a boost of $100 by Buick on its estate wagon a week ago, and an increase of $100 on the Chevrolet station wagon and $75 on the Chevrolet convertible. Truck prices had been increased by Chevrolet from $26 to $162 about a month previously. GMC truck prices were hiked from $55 to $162 on light and medium models and from $17 to $92 on heavy duty types at the time new models were announced in July. The general increase of two to six per cent did not apply to the GMC truck line.

Kaiser-Frazer Corp. boosted the price of the standard Frazer by $99, with no change at present in the price of the Frazer Manhattan or Kaiser.

A Ford spokesman said that his company was still standing on its previous announcement that it did not expect to increase prices immediately. However, several automotive parts companies have indicated that they will follow the GM lead and ask higher prices. One wheel company announced that it would put gradual advances in effect almost immediately, and it was expected that suppliers of bodies, frames, brakes, starters, carburetor and tubing also would up prices soon. If that occurs, in addition to soaring scrap prices, it would seem inevitable that passenger car prices generally cannot remain where they are. One consideration that undoubtedly is going to influence car prices is the anticipation of tooling for 1948 models. Preparation costs are estimated to be up 200 to 300 per cent and higher prices undoubtedly will be a factor in writing off these charges.

Over $3.5 Million Net For Studebaker in 6 Mos.

Studebaker Corp.'s net sales totaled $126,634,619 for the first six months of 1947, resulting in consolidated net income of $3,587,978 after all charges and taxes. This compares with net sales of $46,142,791 and a net loss of $300,800, after applying a tax credit of $9,238,000 against an operating loss of $9,538,800 for the same period a year ago. In the second quarter of 1947, Studebaker's sales amounted to $64,312,403, and consolidated net income after all charges amounted to $1,932,218 as contrasted with sales of $21,007,090 and a net loss of $171,040, after applying a tax credit of $4,882,000 against an operating loss of $5,053,040 for the corresponding period in 1946. Studebaker sold 94,472 passenger cars and trucks in the first six months of 1947; 41,456 were sold



Power for Kaiser-Frazer

Of Continental design, this engine which powers the Kaiser and Frazer has six cylinders with bore and stroke of 3 5/16 in. by 4⅜ in. It is rated at 100 hp at 3600 rpm, and has four main bearings

in the same period in 1946. In the second quarter of 1947 a total of 47,002 passenger cars and trucks were sold, which compares with 17,115 sold in the similar period last year.

Indian Motocycle Merges with R. B. Rogers

The stockholders of the Indian Motocycle Co. recently approved a merger with R. B. Rogers Co., Inc., manufacturer of air conditioning equipment. According to Ralph B. Rogers, president of Indian Motocycle, Indian will continue to make and distribute motorcycles, and will be the surviving corporation. The merger was said to complete a reorganization plan in which Indian will get expanded facilities and machinery, permitting increased motorcycle production. Indian's new capitalization, upon completion of the plan, will consist of 225,000 shares of preferred without par value, 210,298 of which will be outstanding, and 1,250,000 shares of common without par value, 793,126 of which will be outstanding, and 75,000 shares reserved for option to the management. Indian's consolidated net current assets will be increased to $4.6 million as contrasted with $1.6 million before the merger, Mr. Rogers revealed. Indian recently announced that its dealer organization would be expanded by the addition of 500 new dealers by the end of the year.

Dim Prospect in 1947 For 5 Million Cars and Trucks

Chances for a five million car and truck year become more remote with each passing month. Output for July was particularly disappointing with about 383,000 units built, about 40,000 short of the postwar high set in April. From present indications August will be little or no better than July, whereas the industry had been expecting to be rolling along at considerably above 100,000 units a week during the present quarter. Analysis of production estimates shows that that figure was exceeded only three weeks during the months of May, June and July. During the preceding 12 weeks, the industry exceeded 100,000 units eight times. Principal cause of the poor showing in recent months has been critical shortage of sheet steel, although in late weeks there has been a tendency to lose some production through labor stoppages.

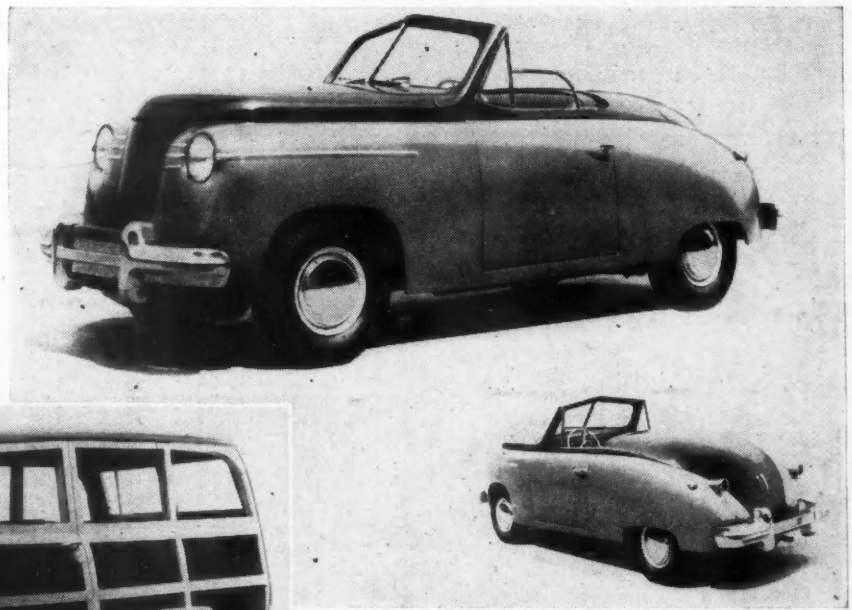
Ford was compelled to shut down for a week starting August 6 because of a strike at Murray Corp. over a clause on union immunity from suits over illegal strikes. Studebaker also was forced to close and Dodge truck operations were curtailed because of the strike. In addition, there were several walkouts during the hot spell when workers claimed it was too hot to work. Hudson also had a few short strikes over disciplining three workers. Taken together, the various shutdowns during the early days of the month made quite a dent in production. Present indications show no sign of any increased output until September at the earliest, and more likely it will be even later this year before enough materials are available to show any substantial increase. Latest predictions estimate production of cars at 3.7 million and trucks about one million this year.

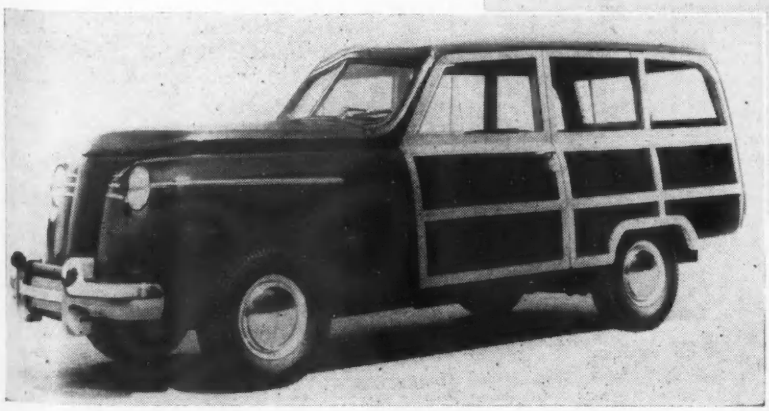
Borg-Warner 1st Half '47 Net Almost $10 Million

Reflecting a great increase in productive capacity and $35 million in expenditures since January 1940 for increasing and improving manufacturing facilities, Borg-Warner Corp. reported a 337 per cent increase in sales in the first six months of 1947 as against sales in a similar period in 1940. Sales in the first half of 1947 totaled $131,504,956; $65,247,921 in the same period in 1946, and $38,979,207 in the similar period in 1940. For the first half year of 1947 net income totaled $9,999,605, as against $1,914,800 in the first half of 1946.

Dodge Expands On West Coast

More expansion on the West Coast for the Dodge Div. of the Chrysler Corp. is on the way. Increased demand for new cars and trucks in the West Coast area, L. L. Colbert, Dodge president, said recently, has necessitated an addition to a Chrysler Corp. plant in San Leandro, Calif., adjacent to its parts plant. Consist-





Bobbi-Kars for Adults

The Bobbi-Motor Car Corp. of Birmingham, Ala., will soon be offering the convertible and station wagon shown above. Bobbi-Kars are powered by four cylinder L-head engines

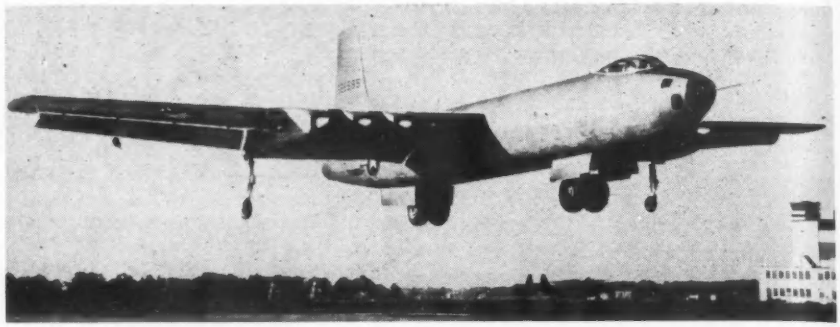
ing at present of a 190,000 sq ft building, an addition of 102,000 sq ft will be added, and projected plans indicate that ultimately about 150 Dodge passenger cars and 80 Dodge trucks will be assembled each day, on an eight hour day schedule. Dodge cars and trucks are now being assembled together with Plymouth cars in the company's plant in Los Angeles; when the new facilities are ready, the Dodge operation will be expanded and moved.

General Motors to Ship 437,000 Engines in '47

General Motors Corp. expects to ship 437,000 replacement engines in 1947, which is about 10 times the output in 1941. This reflects a continuing effort on GM's part to service cars in the field, until new cars are sufficiently available.

Car Financing May Rise With End of Credit Controls

Ending of installment credit controls on October 31, or earlier is expected to lead to a considerable increase in the number of automobile purchase installment contracts. Total credit outstanding on automobile purchases at the end of June accounted for no more than $862 million out of a total of almost $11 billion. At the end of 1941, when consumer credits stood at approximately $10 billion automobile installment buying amounted to nearly $2 billion. In the dying hours of the last congressional session, action was taken to eliminate all installment credit controls next October 31. However, there is some belief that President Truman may lift the credit controls by executive order before that time.



AAF Gets Six Jets

Built by the Glenn L. Martin Co. for the AAF, the first six jet plane completed, the XB-48, is shown successfully completing its test flight. Six GE gas turbine engines, producing 24,000 lb of thrust, power this plane which has tandem-type main landing wheels.

C. & O. and Baldwin Develop Steam Turbine Locomotive

Co-designed by the Chesapeake & Ohio Railway and the Baldwin Locomotive Works for the C. & O., an unusual passenger locomotive converts coal into electrical energy for its wheel drive. The steam turbine-electric locomotive is built as a single unit 90½ ft in length, with a 29¼ ton coal compartment housed in the nose. A 25,000 gal water tender is coupled to the locomotive; the locomotive and tender have a wheelbase of 140 ft, 3¾ in., and the engine alone weighs 411½ tons. Said to be the first steam turbine locomotive ever built, a top speed of 100 mph is reported. Stoking coal automatically into a 310 lb pressure boiler, steam is generated, superheated and introduced into the 6000 hp turbine which is geared down to two main generators having a combined capacity of 4000 kw of electrical energy.

New Truck Registrations*

May and five months 1947 compared with 1946. Arranged by makes in descending order according to the five months' 1947 totals.

	May 1947	April 1947	May 1946	FIVE MONTHS Units 1947	Units 1946	Per Cent of Total 1947	Per Cent of Total 1946
Chevrolet	15,689	22,189	17,217	95,608	30,666	26.01	16.61
Ford	18,939	19,479	10,523	85,357	49,719	23.22	26.94
Dodge	11,952	12,256	10,171	53,875	36,479	14.65	19.76
International	10,616	10,958	6,008	45,284	24,532	12.32	13.29
G. M. C.	4,978	4,964	2,235	22,576	4,649	6.14	2.52
Studebaker	3,745	4,013	2,142	17,063	5,272	4.64	2.86
Willys	4,112	4,021	2,984	16,015	11,314	4.36	6.13
Reo	1,373	1,323	715	6,091	3,113	1.66	1.69
White	1,271	1,251	1,066	5,537	3,826	1.51	2.07
Diamond T	920	952	473	4,216	2,644	1.15	1.43
Mack	925	1,009	460	3,950	3,404	1.07	1.84
Federal	452	544	466	2,277	1,671	.62	.91
Autocar	388	467	337	2,074	1,624	.56	.88
Divco	425	485	437	1,921	1,502	.52	.81
Brockway	330	425	341	1,864	1,503	.51	.81
Hudson	282	333	304	1,513	856	.41	.46
F. W. D.	73	86	62	534	229	.14	.12
Ward La France	34	45		249		.07	
Sterling	58	60	43	239	235	.06	.13
Oshkosh	19	18		104		.03	
All Others	320	270	301	1,275	1,342	.35	.74
Totals	76,901	85,148	56,285	367,622	184,580	100.00	100.00

* Data from R. L. Polk & Co.

Kaiser-Frazer Defers Start Of West Coast Car Assembly

Although the Kaiser-Frazer Corp. assembly plant at Long Beach, Cal., is nearly ready for production, a company spokesman reports that K-F has no plans for production there in the near future. The report is further borne out by recent transfer of executives and engineers from the West Coast development to the Willow-Run plant and to the Detroit Engine Div. The West Coast plant consists of three buildings leased from the WAA last year. The plant formerly was used by Douglas Aircraft Co.

Goodyear Gets CAA Approval For Cross-Wind Landing Gear

The Civil Aeronautics Administration recently gave the first approved type certificate for cross-wind landing wheels to the Goodyear Aircraft Corp. First demonstrated in March, the Goodyear device incorporates the entire working mechanism within the wheels. The Goodyear castering

1947 New Passenger Car Registrations*

Complete returns for May and five Months of 1947.
Arranged by Makes in descending order according to the five months' totals.

Make	May	April	Five Months Units	Five Months % of Total
Chevrolet	62,282	61,569	256,625	20.29
Ford	46,942	43,838	210,905	16.67
Plymouth	28,663	31,610	130,575	10.32
Buick	20,131	21,570	94,492	7.47
Pontiac	19,288	19,551	83,953	6.64
Dodge	18,608	19,402	81,563	6.45
Oldsmobile	16,212	16,402	75,182	5.94
Nash	9,712	11,132	46,202	3.65
Mercury	10,232	9,734	45,908	3.63
Studebaker	9,048	9,658	42,327	3.35
Hudson	9,274	8,720	41,388	3.27
Chrysler	8,358	8,723	37,499	2.96
De Soto	6,424	6,988	28,840	2.28
Cadillac	4,989	4,867	20,841	1.65
Packard	3,652	4,291	17,677	1.40
Kaiser	3,364	3,449	15,276	1.21
Frazer	3,336	2,450	10,132	.80
Lincoln	2,339	2,242	9,985	.78
Willys	2,341	2,419	9,251	.73
Crosley	1,457	1,544	6,109	.48
All Others	67	67	325	.03
Totals	286,719	290,226	1,265,055	100.00

* Data from R. L. Polk & Co.

wheels are now being developed for the Douglas DC-3, 21-passenger transport. The force of strong cross winds blowing up to 90 deg across the runway may be counteracted by heading the plane into the wind on approach and landing. When the wheels contact the runway, they caster automatically, and the airplane, while keeping a "crabbed" attitude into the wind, rolls straight down the runway.

Ward Estimates Output Up For Week Ended Aug. 1

Cars and trucks produced in the U. S. and Canada for the week ended Aug. 1 was estimated at 94,643 by Ward's Automotive Reports. This compares with a revised estimate of 83,807 for the preceding week, and 79,385 for same week a year ago.

Philips' New Engine Runs on Hot Air

A new type of hot air engine has been developed by the research laboratory at N. V. Philips' Gloeilampenfabrieken, Eindhoven, Holland. It is a four-cylinder engine with four pistons, and is said to develop more power for each cu in. swept volume and for each lb dead weight than either a gasoline or Diesel power plant. Since it operates on the principle that work can be obtained from the isothermal high-temperature expansion and isothermal low-temperature compression of air, the new engine uses neither spark plugs or distributor. Air is heated by an external burner, and is directed through a cyclic process of four stages: heating, expansion, cooling and compression. Its operating speed is 3000 rpm or more; the highest air pressure is about 735 psi; and highest temperature 650 C. An advantage claimed is that the Philips' engine can develop a high torque at very low speed. Thus, if it were used in an automobile, the transmission could be simplified or even eliminated entirely. Also, it is said that the new engine could be built for practically any power from one-tenth to several hundred hp.

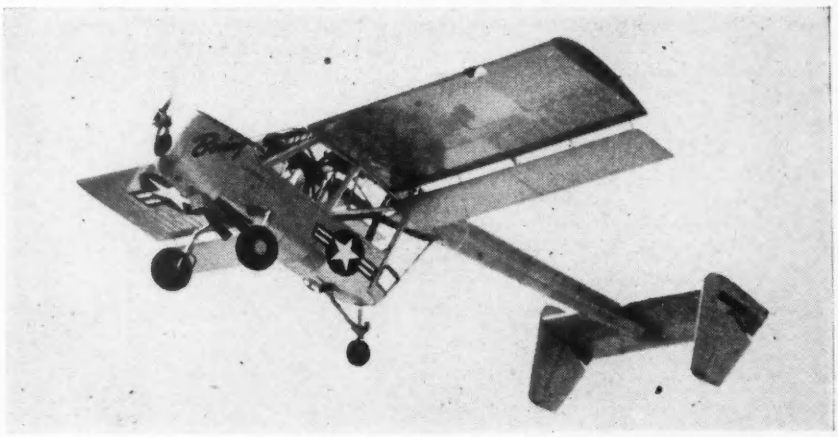
Boeing Builds XL-15 Liaison for AAF

Unconventional in appearance, the Boeing XL-15 liaison airplane is being built at the Wichita Div., Boeing Airplane Co. A 125-hp Lycoming engine powers the XL-15 which can reportedly take off and clear a 50 ft obstacle in 600 ft; climb at 628 fpm; cruise at 101 mph; and land at 35 mph. A "gondola" with a full-swiveling seat, all-around visibility and basic flight controls for emergency use are provided for the observer who is seated directly behind the pilot.

The XL-15 is 26 ft, 2.9 in. long; has a wing span of 40 ft; a height of 8 ft, 8.2 in.; a gross weight of 2050 lb; and a useful load of 541 lb. It can be disassembled and loaded on a 2½ ton Army truck, and can be towed glider fashion, without removal of the propeller, up to 165 mph. Skis, floats, or a Brodie gear for cable landings can be attached, and the XL-15 can be used in either Arctic or tropical climates.

More Activity Reported In Tool and Die Shops

There are signs of coming activity in the tool and die shops in the Detroit area. Currently work in tool and die shops is very spotty, but latest reports indicate that all capacity soon will be in use on new model work. Many shops already are working more than a forty-hour week. It is reported that the tool and die program for the Chevrolet-Pontiac-Oldsmobile series body is beginning to function.



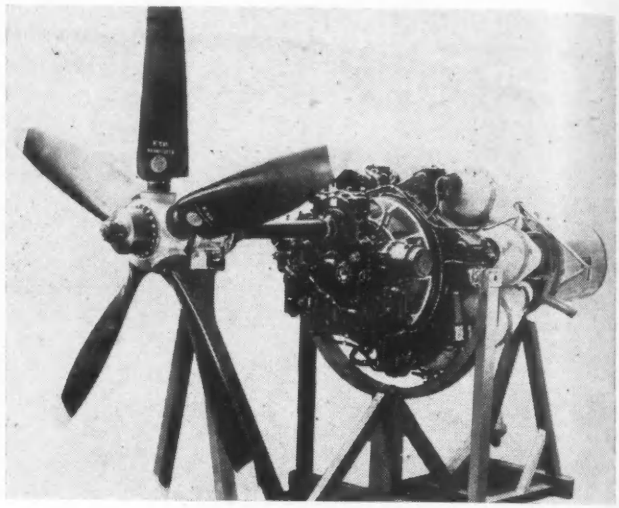
Unconventional Liaison

Shown at a steep angle of climb, the new Boeing XL-15 liaison airplane built for the AAF has an all-metal, high wing design. The "gondola" seat behind the pilot permits all-around visibility. The XL-15 can hover at speeds less than 50 mph.

Jet Engine Drives Propeller in Tests

Experiments comprising more than 1000 hr of test running have now been completed by Rolls Royce with a jet engine driving a propeller. This research has been carried out for the general development of airplane turbines and to determine the effect of the propeller hub on air intake efficiency. It is preliminary to an early start on the production of an airplane turbine driving a propeller. For this work Rolls Royce has made use of a Trent engine, which is basically a Derwent II redesigned with a reduction gear through which the propeller is driven. The Trent reduction gear consists of three layshafts arranged to form a double train of gears driven from the compressor and has a final simple reduction gear to the propeller. The overall ratio between turbine and propeller is 0.141 to one. The gears used in the first design were plain spur type, but due to the high speed of the gear teeth setting up resonant vibrations which coincided with the natural frequency of the tab washers in the gear locking devices, fatigue of these washers occurred, resulting in gear failure. Redesigned to provide additional strength and with a specially balanced drive, this trouble has been overcome.

First flying application of the Trent was on a Meteor airplane with stabilizing fins added. Other modifications were a strengthening of the undercarriage and an increase of the ground clearance to accommodate a 91 in. five blade Rotol propeller. The power absorbed by the propeller is 750 hp, giving a residual thrust of 1000 lb. Although there is no intention of marketing the Trent, which is considered entirely as an experimental job, the lessons learned in this work have enormously advanced the date when the airplane turbine, driving a propeller, will go on the production line.



This Rolls Royce Trent jet engine was redesigned to take a reduction gear through which the Rotal propeller is driven. In its original form, the Trent had a thrust of 2200 lb. In this experimental type, the propeller absorbed 750 hp, leaving a residual thrust of 1000 lb.

Jet Drives a Propeller

British Set Record for Post-War Car Output in June

Producing a total of 29,268 automobiles in June, the Society of Motor Manufacturers and Traders announced that Great Britain hit a new high for monthly production for any month since the war. In the first six months of 1947, exports of 59,556 cars and 23,145 trucks were 46.6 and 30.3 per cent, respectively, of total production.

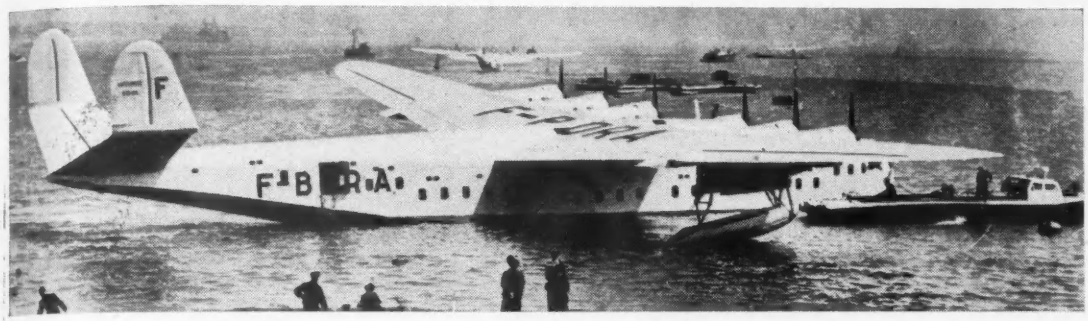
Mammoth Leyland Bus

Now being built in Denmark for the Danish State Railways, a new Leyland-D.A.B. articulated bus will seat 56 persons, and has an 80 passenger capacity. A single decker 54 ft, 10 in. in length, the new bus will have a Leyland tractor unit with a 12 ft, 6 in. wheelbase, powered by a 130 hp Diesel engine with a five forward speed gearbox. Hydraulically operated vacuum servo brakes will be fitted. Dansk Paahaengsvognsfabric is building the semi-trailer which has twin rear axles and a stepped frame. Dansk Automobile Byggeri, Danish agent for Leyland Motors, Ltd., and designer of the bus, will do the body work, it is reported.

Shipments of Steel to Automotive Industries, 1941-1947

Types of Steel	Shipments to Automotive Industries* in Per Cent of Shipments to all Industries			Shipments in Tonnage to Automotive Industries*			Shipments in Tonnage to All Industries		
	Year 1941	Year 1946	First Four Months 1947	Year 1941	Year 1946	First Four Months 1947	Year 1941	Year 1946	First Four Months 1947
Ingots, Billets, Slabs	6.162	10.210	10.359	375,593	367,738	162,360	6,095,237	3,601,638	1,567,357
Wire Rods	6.382	2.567	2.721	90,190	26,352	7,870	1,413,128	1,026,504	289,232
Structural Shapes	0.637	1.518	1.846	31,579	52,836	27,298	4,960,822	3,479,683	1,478,498
Plates	3.906	6.181	5.979	230,128	272,137	123,721	5,890,837	4,402,890	2,069,292
Hot Rolled Bars	25.192	22.897	22.902	1,995,530	1,658,550	696,834	7,921,370	7,243,523	3,042,634
Cold Finished Bars	20.830	15.961	18.143	292,084	242,126	115,069	1,402,195	1,516,969	634,225
Tool Steel	11.026	1.406	1.177	18,686	1,355	412	169,469	96,391	35,004
Pipes and Tubes	1.567	1 874	2.047	92,952	89,805	40,952	5,933,309	4,791,094	2,000,101
Wire Products	6.529	5.032	5.447	250,983	170,933	79,994	3,844,325	3,396,978	1,468,522
Black Plate	1.030	1.133	1.219	4,971	10,309	3,687	482,378	909,516	302,409
Tin and Terne Plate	0.239	0.276	0.334	9,005	7,833	3,636	3,768,206	2,833,830	1,088,502
Sheets and Strip	32.712	15.843	30.279	5,450,546	3,933,857	1,895,072	16,662,039	14,829,598	6,258,655
Other Products	0.619	.....	.....	44,497	.....	181	7,184,277	4,944,807	2,019,933
Total Shipments	13.521	12.969	14.186	8,886,744	6,893,831	3,157,086	65,727,592	53,073,421	22,254,364

* Include manufacturers of passenger cars, trucks and other commercial vehicles, tractors, parts and accessories suppliers, and independent automotive forgers.
NOTE: The above table was compiled from data supplied by the American Iron and Steel Institute. No account has been taken of shipments to members of the steel industry for conversion or resale.



Intended for French trans-Atlantic air service, the giant six-engined Latecoere 631-04 flying boat shown here being nosed into her berth at Hythe, Eng., weighs 72 tons and has a wing span of 187 ft. Acme photo

Brobdingnagian Air Liner

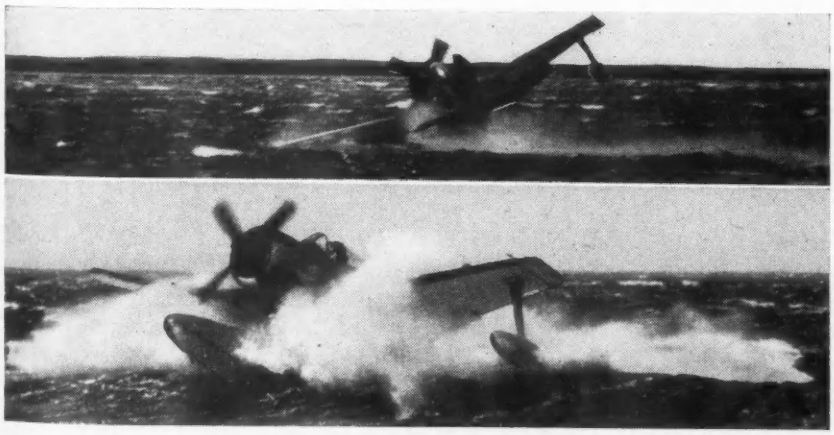
Labor

Ford Averts Strike

After walking right up to the brink of a major strike, the UAW and Ford Motor Co. reached an eleventh hour agreement, averting what would have been a major strike in the automobile industry over the provisions of the Taft-Hartley Labor Act.

The union had been insisting on the complete waiver of the company's right to sue the union in case of an unauthorized work stoppage. Ford, on the other hand, had countered with an offer that the company would waive the provision under certain conditions.

But an eleventh hour settlement representing a compromise by both parties averted the walkout. The agreement provides as follows: "(1) That a four-man committee, two from the union and two from the company, will be appointed to work out a solution to the question of the liability of the union, its officers and members, for damages by suit for breach of contract. (2) If this committee is unable to arrive at a unanimous solution within three months of the date of the contract, it will choose a fifth member of the committee. The Ford-UAW-CIO umpire will serve as the fifth member if the committee cannot first agree on some other person. (3) The committee then will continue its efforts to arrive at a solution for an additional three-month period if necessary, or longer, if additional time is required and voted for by a majority of the committee. Any solution reached by the committee must be unanimous, and will be binding upon both company and union. (4) In the event of failure to arrive at a solution the union may reopen direct negotiations on this issue with the company. However, the total time spent in such deliberations and negotiations shall not exceed one year in all. (5) The union, its officers and members shall not be liable for breach of contract because of any strike or work stoppage which may occur during the period of these deliberations and negotiations. The company will not institute any suit against the union, its officers and members in such event. The company will be able to avail itself of all other remedies provided in the contract in the case of strikes or work stoppages. (6) The union has the right to terminate the contract if the company violates the above provisions. (7) If the committee is unable to find a solution, after a year of deliberation and negotiations, the union will retain the right to strike on this issue. (8) In the event such a strike should occur, all other provisions of the contract will remain in full force for the entire term of the contract."



Rough Testing

Successfully completing rough water landing and take-off tests in over five ft waves and 35 mph winds, this Curtis SC-2 Seahawk, Navy scout observation seaplane, is powered by a Wright Cyclone engine and has a top speed of over 250 mph. A permanent seat inside the fuselage with a separate access door has been provided for easy entrance in recue work

Metals

Copper

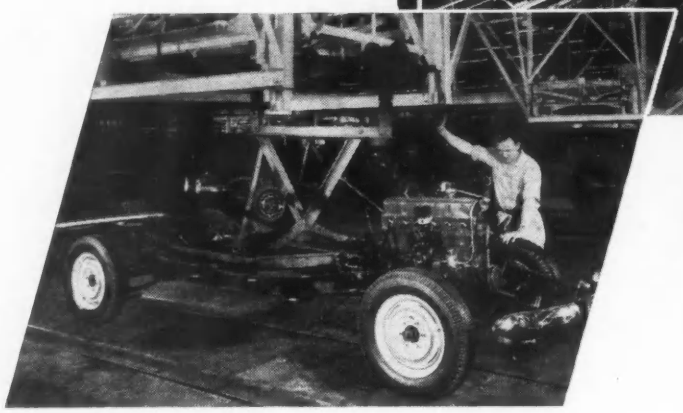
The expected downward price revision as a result of an improved copper supply looks a bit bleak at the moment in the face of threatened strikes affecting leading copper producers. With the end of the brass mills vacation period in sight, they are actively back in the copper market, and peak capacity operation continues for wire mills. This coupled with the anticipated loss of production from expected strikes forecasts a future price rise.

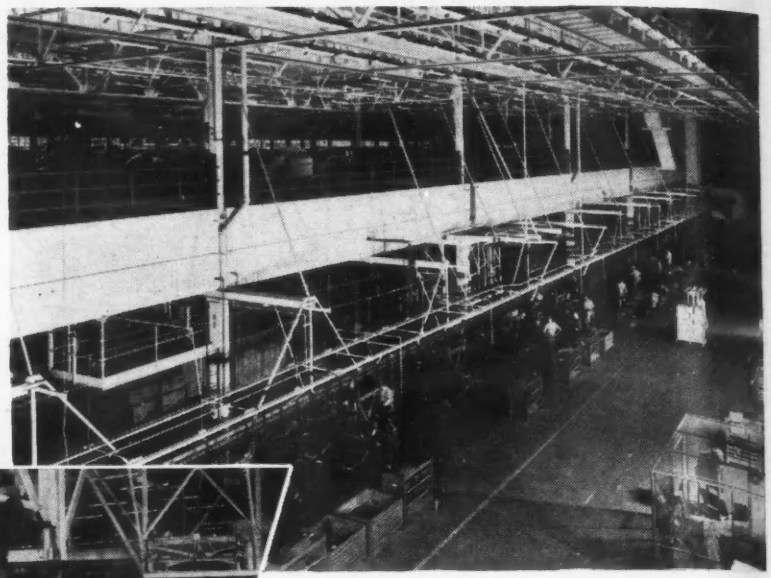
Lead

Gen. Douglas MacArthur's April report reveals that unstated quantities of lead, scheelite, wolframite, and tungsten will be sent to the U.S.

(*Turn to page* 90, *please*)

(Below) At the end of the suspended assembly line the chassis becomes power-free and is pushed into the elevator shown here. The chassis, still suspended on its carrier, is lowered onto its wheels and from here on rides the floor conveyor. Subsequently, the elevator raises the empty carrier to a higher level where it is picked up by the return chain and transported to the beginning of the suspended assembly line





(Above) A view in the new Chevrolet assembly plant at Flint, showing the second floor mezzanine and the suspended assembly line approaching the spray booths in the background at the right. Note the ceiling height and excellent lighting

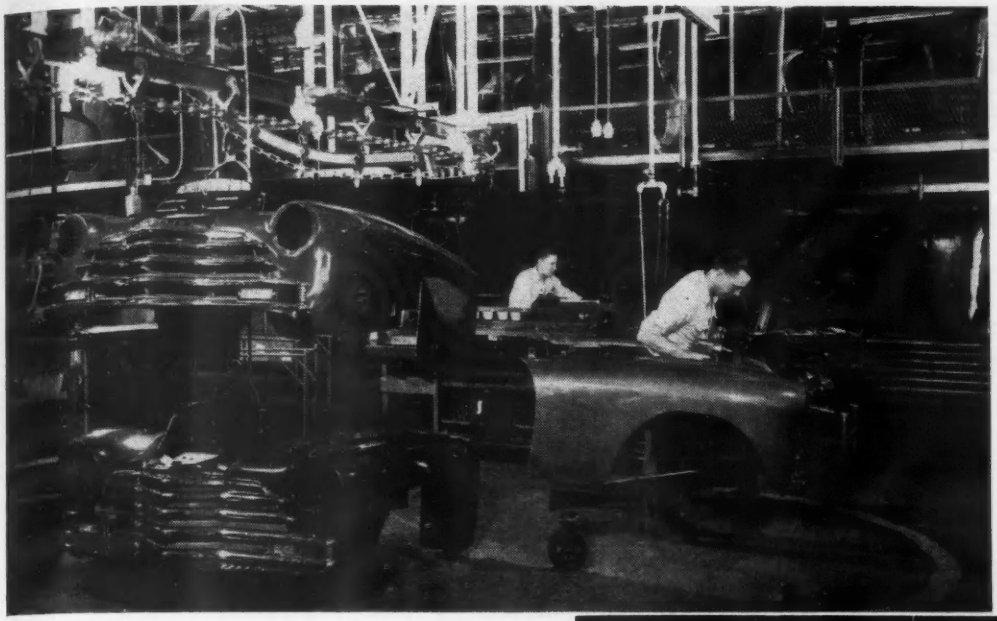
Ultramodern

Production Features at Chevrolet's

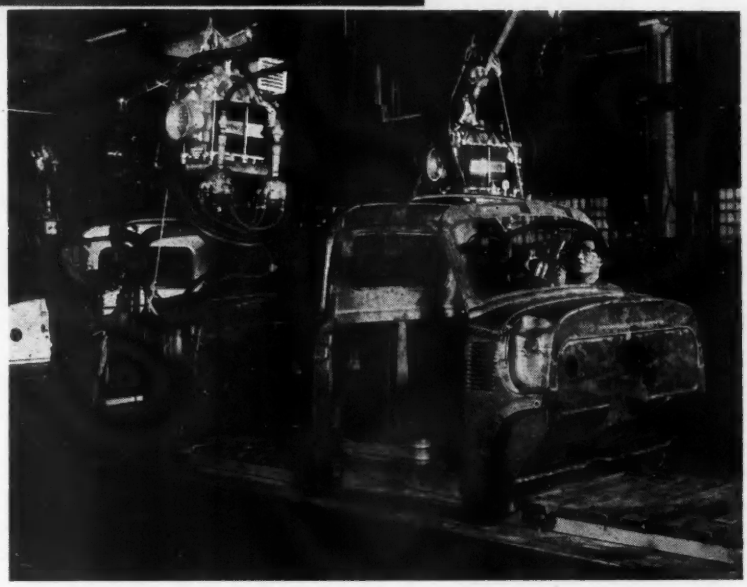
THE new Chevrolet assembly plant on the outskirts of Flint, housed in a modern building built for the purpose within the past year, is the embodiment of advanced concepts in industrial design and mass production equipment. Distinctive from the management standpoint is the partnership of Chevrolet and Fisher Body Divisions which made it possible to house a self-contained Fisher body assembly plant under the same roof, the two being separated only by the under-roof freight dock.

Actually this plant may be considered a three-in-one unit since it houses passenger car assembly, Fisher Body assembly, and truck assembly as well as truck body fabrication, the latter being a Chevrolet function. Metal finishing operations are concentrated on a second floor mezzanine, leaving an enormous bay with a clear height to the ceiling of around 60 ft for the full length of the main aisle. This spaciousness assures personnel comfort since neither light nor ventilation is a problem.

Considering the Chevrolet operation alone, the plant layout boasts 15,000 ft of overhead conveyors, 3700 ft of floor conveyors, and 282 ft of gravity roller conveyors. Thus a grand total of 18,982 ft of conveyor lines serves the passenger car and truck assembly lines—passenger cars and trucks being built



(Below) Resistance welding operations are completed on truck cabs while they are in motion on this pallet conveyor



(Above) At the left foreground of this picture is the overhead conveyor for picking up front end sheet metal assemblies. In the foreground at the right is a unique fixture for the installation of radiator cores. The front end sheet metal units are assembled on special bucks shown in the background at the extreme right

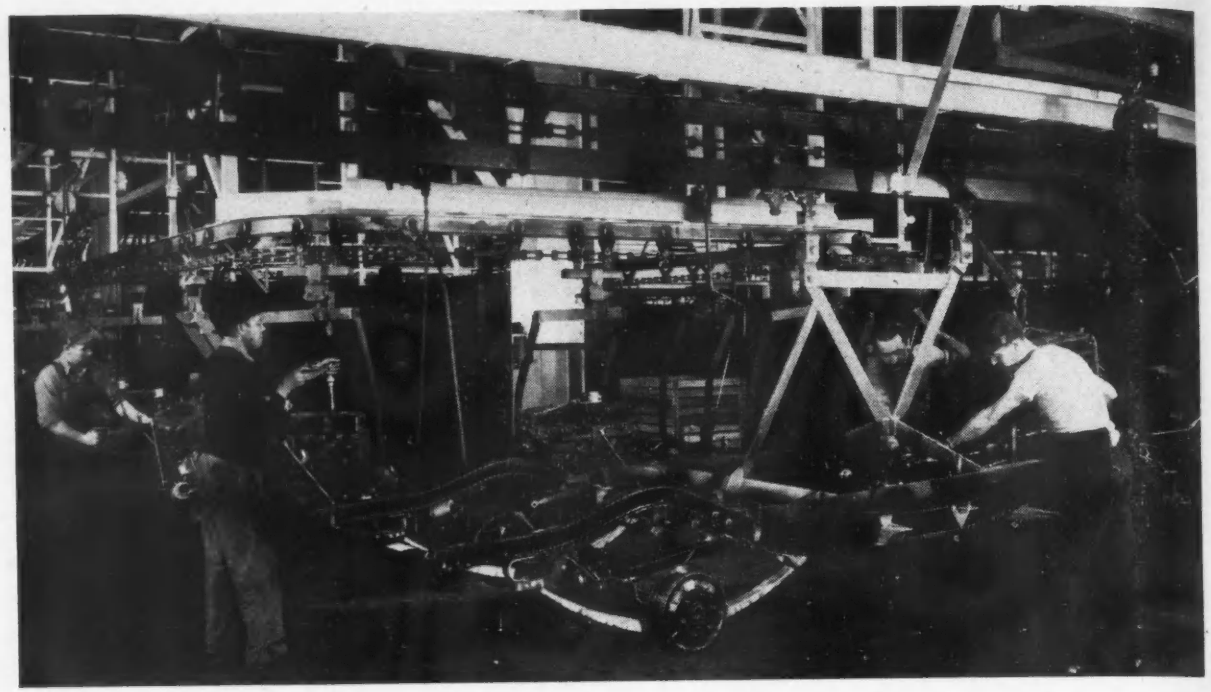
By Joseph Geschelin

New Flint Plant

in separate departments. An outstanding feature is the unique suspended conveyor line for passenger car assembly. Although the use of a monorail assembly line for this purpose is not new, in layout and in mechanical detail the Chevrolet conveyor is certainly a "first" in the industry.

The Chevrolet passenger car plant assembles the chassis frame as a simple automatic operation at the first station of the assembly line. This station is a frame assembly fixture of massive construction to assure accuracy of locating and squaring the frame members. Serving this fixture are two frame side rail welding machines, one on each side of the conveyor line, for welding right and left parts. Automatic resistance welders of rigid design serve to join the variety of brackets to the prepared box-section side rail. The few rivets still required at certain points are made up by means of 4000-lb hydraulic squeezers. The Chevrolet frame is integrated by assembling its side members and cross rails in a single automatic operation at the first station, taking in as well the entire front suspension assembly as an integral mounting.

Of more than passing interest to production men is the general adoption of Supercycle portable tools, another Chevrolet "first," operating on 360-cycle current as contrasted with the familiar Hicycle 180-cycle current system. At the present time the Supercycle installation is confined to buffers and polishers while the Hycycle equipment is standard on the assembly line for the various portable tools. One of the advantages of the Supercycle principle is that these tools



This photograph shows the suspended engine conveyor approaching the suspended chassis conveyor line at right angles

are considerably smaller and lighter, thereby reducing operator fatigue. At the same time, they have an enormous torque capacity.

Moving along the assembly line, we find other noteworthy techniques. A big time saver is the semi-automatic spring covering machine in which the spring is lubricated and encased in the steel sheath, which is clinched in place with unusual rapidity.

Brake bleeding and filling of the hydraulic system has been simplified and speeded by combining both pressure and vacuum, pressure being employed to fill the lines while vacuum serves to draw off the trapped air. Each of the vacuum connections has a short sight glass which shows the movement of air bubbles and when completely clear indicates to the operator that the line is properly filled and bled. Tires are inflated on a straight section of gravity roller conveyor, using an air pressure line regulated by an electronically controlled shut-off.

At the station where the cooling system is filled, there is provided a self-contained circulating system for filling with a suitable anti-freeze mixture during the season of winter deliveries.

Engines are received

(*Turn to p.* 82)

Immediately past the elevator station a finished body is lowered onto the chassis as it moves along on the floor conveyor section of the final assembly line

Corrosion resisting coatings are applied on even the smallest fastenings. This big unit is used for cleaning and Granodizing all manner of brackets and fittings used in the assembly of cars

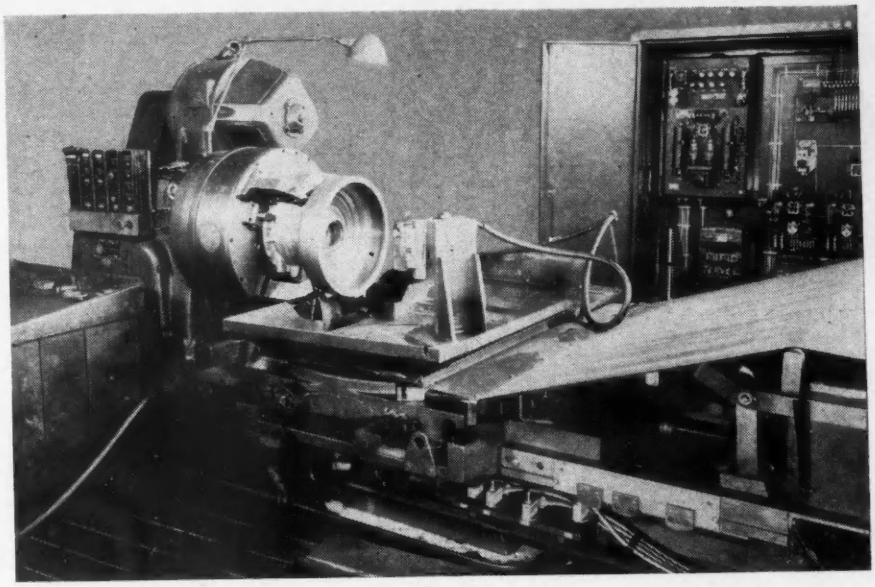


Fig. 1 — This electronically controlled machine was designed and built by Spicer for automatic contour turning of the torque converter housing cavity. The tool is mounted on a turn-table, as shown, and is controlled in its movement by the electronic cabinet at the right background

Special-Purpose Machinery For High-Volume Output

THE Spicer Manufacturing Division, Dana Corp., Toledo, Ohio, has designed and built special production machines for manufacturing in large volume such parts as torque converters, axles, turbine rotors and propeller shafts. This is particularly in evidence in the torque converter department where high-volume methods are essential for producing the large number of blades required for each torque converter.

Torque converter blades are made of brass which is supplied in the form of extruded bars. The bars are die sheared to length. Then they go to an interesting machine, built by Snyder, which produces hinge pins by hollow milling on each side of the blade; and, at the same time, holds the width of the blade body to size within 0.002 in. The machine is of double-end type with a large 15-station drum fixture for holding the blades. Each tool head has six sets of tools—three for roughing and three for finishing. The cycle is completely automatic save for loading and unloading of fixtures, and is timed to produce 600 pieces per hour.

Several other unique machines are found there. One of these, as shown in (*Turn to page* 80, *please*)

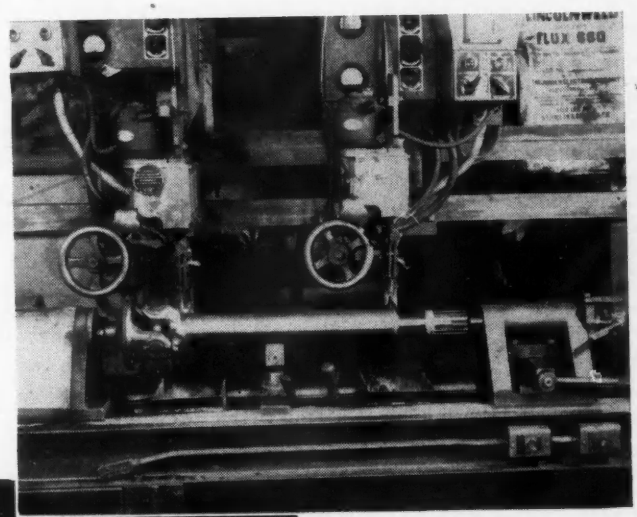


Fig. 2 (Above)—Shown here is the submerged arc-welding machine which was designed by Spicer for welding propeller shafts. The two automatic electrode feeding heads are Lincolnweld units

Fig. 3 (Left) — This center-drive lathe, built by Spicer, turns axle shafts in one setting

German Automobile Industry *Must Restart From Scratch*

By Leo Vogel
Vienna Correspondent

IN PREWAR Germany the production of automobiles occupied an important place in the armaments program. The production of passenger cars, trucks and buses rose from 473,000 vehicles in 1928 to 1,600,000 in 1938. During this period, Germany was able to increase her share of automobiles in the world from 1.6 to 4.5 per cent. The accompanying table compares the growth of automobile registration in the United States, England and France, with that of Germany.

In 1928 Germany had one motor vehicle for every 128 persons while in 1938 there was one for every 40 persons. Peak production was reached during the three years preceding the war. The production for 1936, 1937 and 1938 was respectively 303,868, 328,267 and 363,000 units. Army vehicles are not included in these figures This heavy program was achieved through a 24-hour workday so that, finally, including Austria and Czechoslovakia, Germany entered the war with almost 2,000,000 motor vehicles. At present it is now known exactly how much damage the automobile industry suffered as a result of the war. As an estimate, perhaps at the most there are now 400,000 vehicles in operation, so that Germany is back at the 1928 level.

Automobile Registration in United States, England, France and Germany for the Years 1928 and 1938

	Passenger Cars	Trucks and Buses	Total
UNITED STATES			
1928	21,379,125	3,113,999	24,493,124
1938	25,264,589	4,153,389	29,417,978
Increase	3,885,464	1,039,390	4,924,854 or 20 per cent
ENGLAND			
1928	900,557	408,776	1,309,333
1938	1,984,430	593,410	2,577,840
Increase	1,083,873	184,634	1,268,507 or 97 per cent
FRANCE			
1928	643,000	306,000	949,000
1938	1,800,000	470,000	2,270,000
Increase	1,157,000	164,000	1,321,000 or 139 per cent
GERMANY			
1928	351,000	122,000	473,000
1938	1,226,000	374,000	1,600,000
Increase	875,000	252,000	1,127,000 or 238 per cent

According to the production program permitted by the Allied Control Council, Germany may produce 80,000 motor vehicles yearly (40,000 each of passenger vehicles and trucks). Thus, it would take at least ten years to reach the 1938 registration level again, for the constant loss of worn out vehicles must be taken into consideration. At present, the German automobile industry is not at all in a position actually to produce the permitted number of vehicles; it cannot produce more than a total of 40,000 vehicles of all types. Difficulties of the war and the postwar period and the lack of skilled labor, as well as the loss of 12 factories, prevent the realization of the permitted capacity.

The following factories have been eliminated: Auto-Union (DKW, Audi, Horch, Wanderer); Ford, Hanomag; Hansa-Lloyd; Maybach; Stoewer; Bussing-NAG; Krupp; Magirus; Henschel, and Vomag. Also the Bayrischen Motorenwerke (BMW) no longer exists; in its place is the Eisenacher-Fahrzeug—G.m.b.H., the production of which, however, is not available to domestic needs. The well known English sport automobile factory, Frazer-Nash, which produced BMW automobiles before the war on a license basis, has now begun, together with the airplane plant in Bristol, to release for sale the BMW models 336 and 328 as "Bristol 400." At present, only the Daimler-Benz, Opel, MAN, Adler, and the former Volkswagen-Werk are in operation.

Before the war, the production of passenger cars was in the hands of 13 companies which produced about 295,000 vehicles annually, in 37 models. At present the number of plants has shrunk to three, with a yearly production of only 31,200 units. This does not include the Eisenacher-Fahrzeug G.m.b.H.—since its six-cylinder model is destined only for an occupying power. Daimler-Benz produces monthly 1000 vehicles of the former four-cylinder 170 V model at a price of RM 4200 up. The former Volkswagen-Werk, now the Wolfsburger Motorenwerke, is placing on the market its four-cylinder, air-cooled model with the engine in the rear, at a price of RM 5000. Monthly production is 600 units. Opel, which previously, among other

things produced spare parts for General Motors Corp., has finished preparations for the production of the four-cylinder Olympia model, which will soon be available at a price of RM 5500. The production rate will be 1000 units monthly.

Preceding the war, 18 plants were producing trucks, putting out 68,000 units in 58 models. Today there are only four plants producing 15,000 units per year in six types. Monthly production at Daimler-Benz is 400 units of a 4.5 ton six-cylinder model at a price of RM 15,000, and 500 units of a three ton four-cylinder model for RM 12,000. Opel is represented with a 1.5 ton four-cylinder model with a monthly production of 150 units at a price of RM 6800. MAN produces a six ton six-cylinder model at a rate of 100 per month and a price of RM 20,000. Adler produces a 4.5 ton six-cylinder model at the rate of 80 units monthly and a 6.5 ton six-cylinder model at a rate of 50 units monthly. The former sells for RM 18,000 and the latter for RM 20,000.

Nationalization Undergoing Crisis in Czechoslovakia

NATIONALIZING of industries in Czechoslovakia is causing a number of changes to take place in its automobile industry. Before the last world war, the production of motor vehicles was in the hands of seven factories, which produced yearly 16,000 units—12,000 passenger cars and 4000 trucks. The overwhelming majority of these vehicles remained in the country, to satisfy domestic demand; the export in 1938 was only 1000 passenger vehicles and 100 trucks. The capacity of the factories could easily have been raised, for an increase in domestic use would have been quite possible, if state taxation and the price of the motor vehicles had not limited private motor car use to such an extent. Thus, in 1938, there was one vehicle for 140 persons, and Czechoslovakia stood fourteenth among the 19 continental European nations, as regards motor vehicle registration. At the beginning of the war in 1939, there were registered over 83,000 passenger vehicles, 28,000 trucks, and 4200 buses.

Under the nationalized plan the production of 20 prewar types of passenger cars and 10 trucks has been limited to three passenger types and four truck types, so as to avoid an irrational division of production. Three factories, Jawa, Skoda, and Tatra are producing passenger cars while Skoda, Praga, and Tatra are producing trucks.

The two-year plan being applied, provides for the production of 15,000 passenger cars and 4000 trucks, a production figure reached only in the year preceding the war. A higher production is hoped for if the raw material and tire situation improves. Whether this hope will be realized or not cannot yet be stated, for the nationalized industries of all types are at present undergoing a crisis, as responsible quarters themselves admit. The Minister of Industry, Dr. B. Lausmann, in discussing the unsatisfactory situation in the national undertakings, as regards finance and production, referred to the lacking organizational activity of the leading workers, the too great outlay on the budget item "Works Committee" and the too small worker productivity.

Concentrate on Exports

While it may be a question here of "children's diseases" of the young nationalized industries, these phenomena do have a restrictive effect on the automobile industry, to which there falls an important role in the national exports. Already, no less than 50 per cent of the production is going abroad. Efforts are being made to increase this export, especially to those countries that were previously supplied with motor vehicles by Germany (the export is centralized in the export section of the Czechoslovakian Metal Industry and Machine Construction Establishments, national undertakings). Once the English and American automobile production, after satisfying their own needs, set foot in Europe, the prospects for Czechoslovakian exports will be much less, particularly since their products are not especially low-priced. Within the country, for example, the light "Jawa Minor II" costs 60,000 Kc (about $1200) and the "Skoda 1101" 71,000 Kc (about $1420). A lowering of prices for export to meet competition could be accomplished only through the attainment of mass production, and through the reduction of wholesale prices. According to the Czechoslovakian Statistical Institute, the latest price level is about three times that of 1938. The constant downward movement in present exports gives cause to worry. Compared to December, 1946, total exports for January of this year dropped again, around 27 per cent. February exports fell more than 16 per cent short of the preceding month.

It must be objectively stated, that even if the automobile industry were still private, as before the war, it would still have a hard battle, in view of the postwar difficulties (lack of raw material, tires, skilled workers). It will be possible to pronounce definite judgment on the justification of the nationalization only after the end of the two-year plan, even though the interim statement given here shows that the results which were expected have not been attained.

Domestic Car Supply Low

Automobile users themselves are not fully in agreement with the efforts of the national undertaking toward exportation. Since only 50 per cent of the total production, which comes to 600 passenger vehicles a month, enters the domestic market, there is a shortage of new vehicles. The state has therefore introduced a strictly administered distribution procedure, to give priority to the needs of official and sanitation services. As against 83,000 passenger vehicles at the beginning of the war, there are circulating at present at the most 45,000 cars. The truck situation is better, due to the fact that UNRRA brought 13,000 vehicles into the country. On the other hand, there is a great shortage of buses, the production of which is still in the initial stages; as far

(*Turn to page* 88, *please*)

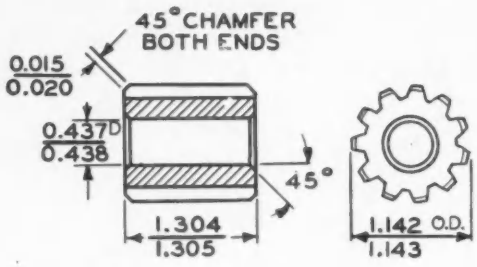


Fig. 1—This oil pump gear was made by the Ford Motor Co. from a standard powered iron bearing material by means of an unique extrusion process in the restriking operation

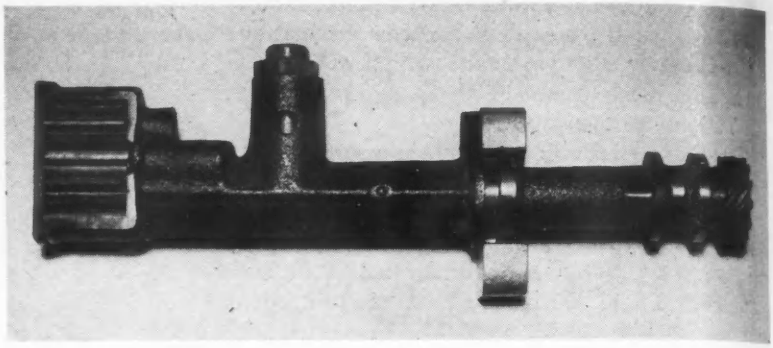


Fig. 2—Ford oil pump assembly. The iron powder gears can be seen at the left

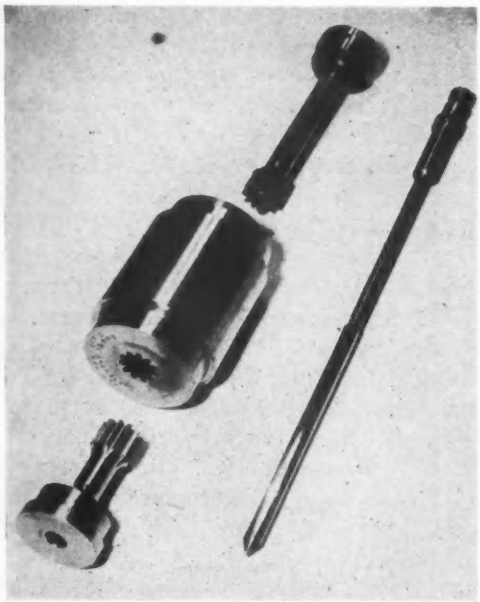
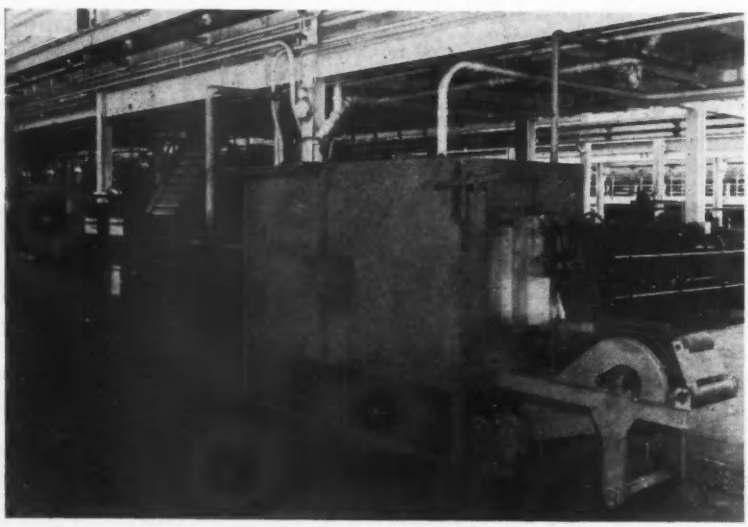


Fig. 3 (Above)—Preforming tools for the oil pump gear consist of a die, punches and a core rod

Fig. 4 (Below)—This continuous mesh-belt electric-resistance furnace is used by Ford for sintering the metal powder parts



Ford Utilizes Extrusion Method For Producing

BY MEANS of new tools and a new idea of metal powder processing, the Ford Motor Co. has evolved a method of producing metal powder parts at a lower cost and to closer tolerances than has been possible heretofore with conventional tools. The new concept involved is that the restriking of metal powder parts may be considered as an extrusion process, using punches, a die body and an extrusion plate for external sizing of the part.

This process was developed for an oil pump gear, measuring 1.30 in. in length and containing a 0.437 in. diam hole, as shown in Fig. 1. Working tolerances specified that the pitch diam of the teeth must be concentric with the hole within 0.002 in. and that the length must be within plus or minus 0.0005 in. The oil pump assembly is illustrated in Fig. 2.

The metal powder used was a standard powdered iron bearing material composed of 90 parts iron, 10 parts copper and 1.5 parts calcium sterate. Those powders were mixed in a specially designed three-stage mixing machine consisting of two ribbon mixers and a screen.

From the mixer the powder was preformed in a Stokes "S" press to a density of 5.5 grams per cc. The tools for this press, shown in Fig. 3, consisted of a die

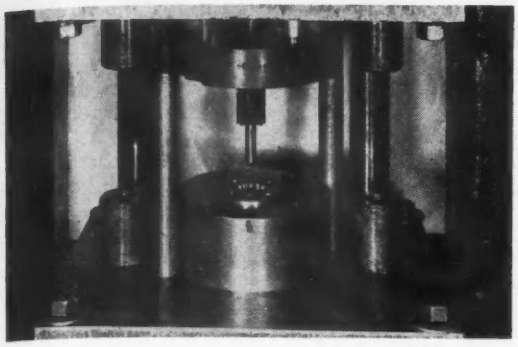


Fig. 6—Ferracute press arrangement used to restrike the gear. The top core rod can be seen extended through the punch which is poised above the die

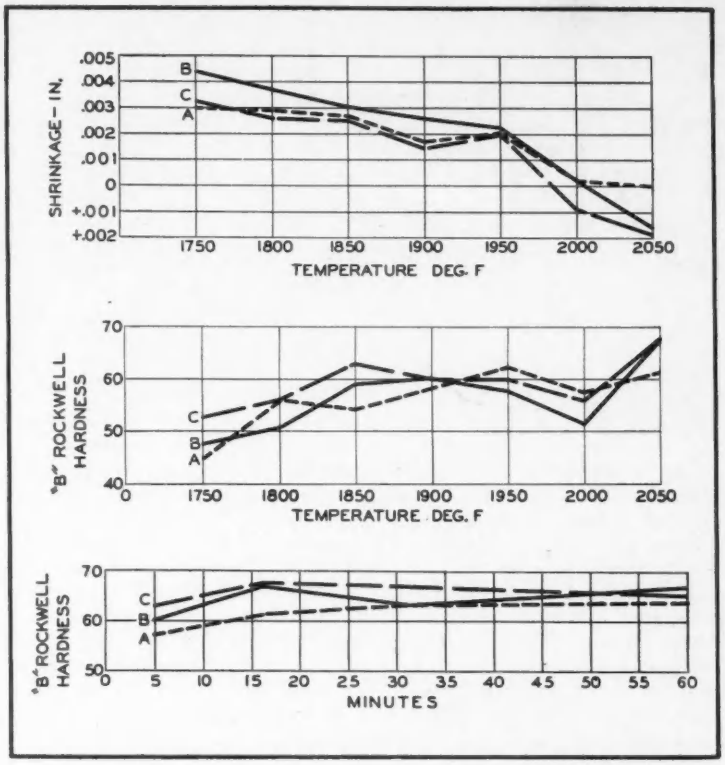


Fig. 5—The test results given in these curves were obtained with compacts compressed at line pressures of 80 psi (12.5 tons) for A, 100 psi (15.7 tons) for B, and 120 psi (18.8 tons) for C. At top is shown change in size with change in sintering temperature; at the center is variation in hardness with respect to sintering temperature; and at bottom is variation in hardness with respect to time

Metal Powder Gears

By E. E. Ensign

Ford Motor Co.

broached from oil-hardening manganese tool steel, upper and lower punches of chromium-nickel chisel steel and a core rod of high-chromium high-carbon steel.

The broaching and lapping of the first die, which was about seven in. long, was difficult and expensive. Subsequent dies were less expensive since the original broaches could be used repeatedly. Selection of the steels for the preforming tools and their correct heat treatment, was the most difficult part of the preforming operation.

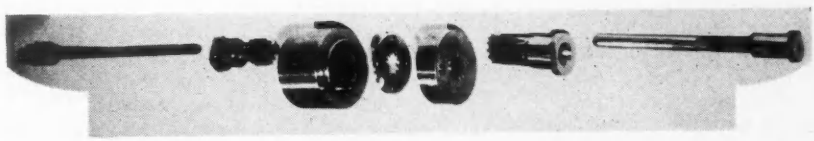


Fig. 7—The restriking tools are shown here in their relative positions, from left to right: core rod, punch, guide nest, extrusion plate, die body, punch, core rod

After preforming, the parts were sintered in a continuous alloy-steel mesh-belt electric-resistance furnace (see Fig. 4) at 2040 F for 20 min with a reducing gas atmosphere generated by cracking propane. The curves in Fig. 5 give the effect of sintering time and temperature on gear size and hardness. The time, temperatures and rate of heating used in producing the gear were set to insure a slight growth of from 0.001 to 0.005 in. in the diameter of the gear. This growth served to provide sizing stock for the gear teeth and to make the hole oversize. When the gears were cooled to room temperature, they were dipped in die lubricating oil and then restruck in a straight-side single-acting Ferracute press, shown in Fig. 6. The restriking sized the gear to all finished dimensions except length. To assure the correct length, it was necessary to leave additional stock and grind to the correct length on automatic grinders.

Following the grinding operations, the gears were impregnated with oil in a vacuum autoclave. The reduced pressure was provided by a mechanical vacuum pump and provision was made to heat the oil; however, in the case of the gear this was not done. The impregnating was used primarily for the purpose of cleaning the part and providing a degree of rust proof-

(*Turn to page 72, please*)

by Robert McLarren

British Lead

As energetic as U. S. gas turbine plans appear, they are a reflection of British leadership in aircraft gas turbine work. Latest evidence is the revelation that the new British Metropolitan Vickers F-3 jet engine has a specific fuel consumption of only .65 lb/lb thrust/hour. By comparison, the GE-Allison J-33 turbojet engine, as used in the Lockheed P-80A Shooting Star, has a consumption of 1.18 lb/lb thrust/hour. Reduced fuel consumption is the most pressing research problem in the aircraft gas turbine field. The Navy is installing a Rolls-Royce Nene in a new Grumman experimental fighter and both the Army and Navy are conducting test programs on the Nene and Rolls-Royce Derwent.

Miniature Turbojet

Boeing's newly-developed pair of low-powered turbojet engines suggest a multitude of possible applications. Model 500, which weighs only 85 lb yet delivers 150 lb of thrust, has undergone about 100 hr of bench tests, component parts having received nearly 1000 hr. Applications of Model 500 include guided missiles, glide bombs, light aircraft or as a started engine for large rocket powered or jet powered missiles. A development of the basic unit, the Model 502 turboprop power plant weighing 140 lb is suitable for use in light planes, in large planes as an auxiliary power plant, boats or stationary power plants.

First Jet Airliner

England may yet be the first to produce a turbojet-powered airliner, according to a recent list of scheduled flight dates of new British transports which reveals plans for the first flight test of the Avro Tudor VIII early in October of this year. This 40-passenger craft is powered by four Rolls-Royce Nene turbojet engines. There are no turbojet-powered airliners in prospect in the United States for at least two years.

Final Action

The Civil Aeronautics Board has circulated a proposed amendment to the Civil Air Regulations requiring all scheduled transport aircraft to be equipped with a terrain proximity indicator by Jan. 1, 1948. This is one of the first proposed amendments to result from the findings of the President's Air Safety Board, although others are expected shortly. The Hughes terrain clearance indicator is being installed on all Trans World Airlines transport, and United Airlines has announced the purchase of 200 RCA units of similar design. Both indicators utilize radar as basic elements with a predetermined altitude above obstacles set in the device. As the aircraft-to-ground distance falls below this pre-set distance, a light flashes in the cockpit. In addition, a needle indicator on the instrument panel provides a continuous indication of the ground contour below the airplane.

Largest Bomb

The 42,000-lb bomb, recently announced by the AAF has posed a number of unique problems. Firstly, extensive modifications were required to convert a Boeing B-29 Superfortress for carrying the bomb. These included the removal of the rear bomb bay door, extensive cutting away of the structure on either side of the bomb bay, the cutting out of large portions of the front bomb bay doors. Considerable stiffening was required along the bomb bay sides to compensate for the removed structure. The bomb is 322 in. long and 59 in. in diameter and about one-half projects below the B-29. A total of 11 of the bombs is on hand, all manufactured by the A. O. Smith Corp. of Milwaukee, Wis. First delivery of two bombs was in September, 1945, and the remainder followed shortly afterward. Since that time they have been in storage awaiting an airplane capable of mounting the 21-ton monster. Still undetermined are the aerodynamic characteristics of the bomb during its trajectory to the ground and the structural and aerodynamic effects of its release on the B-29, which will be accelerated directly upward ½G due to its release.

Prototype Production

Glenn L. Martin Co. created a "factory" within a factory to build the XB-48 six-jet bomber in the record time of less than 14 months. Within a special corner of the shop, miniature engineering, production, procurement and inspection departments were created, each working side-by-side with orders to forget precedent and "get the job done." An accounting section was located desk-to-desk with the engineers and machinists and blueprints were made in "while-you-wait" style. Close by was the XB-48 mockup to provide constant access for checking. Raw stock was accumulated in the department and the airplane was jigged and assembled right in the heart of this heterogenous group. The speed with which the airplane was carried through from initial design to flight test is ample proof that this technique is the most successful yet demonstrated for the production of a single prototype aircraft.

Lightplane Changes

Two recent moves in the personal aircraft industry may have far-reaching consequences as a prelude of things to come. Ryan Aeronautical Co., after purchase of all design and manufacturing rights, production tooling, work-in-process and spare parts for the North American Navion, announced that quantity production will be resumed in September or October at its San Diego plant. Sale of the Globe Swift to Texas Engineering and Manufacturing Co. involved little more than a change of title from Temco has been manufacturing major assemblies of the plane for Globe for several months. Although the current lightplane sales slump is not serious in the opinion of major producers, it obviously is severe enough to throw marginal operations deep into the red with resultant liquidation. These operations have resulted from large development costs, overstocked raw-stock and purchased parts inventories, high labor and manufacturing costs and production planning on the basis of large volume.

New Navy Missile

The Navy has announced the "Neptune," a research missile designed to reach an altitude of 1,255,000 ft. (about 237 miles). The new missile is a redesigned V-2 of much smaller diameter but features a rocket motor mounted on gimbal rings in such a manner as to permit rotation of the motor itself for control. The missile is being built by the Glenn L. Martin Co. and should be ready within a year for test firing. It is 45 ft long and is expected to reach a speed of 4570 ft per sec. It will carry instruments to record data on temperature, cosmic rays, the ionosphere and other scientific fields.

Farmall Cub *Details*

RECENTLY announced by the International Harvester Co., the Farmall Cub tractor specifications and sectional drawings are presented on this page. The engine has a specially-designed high-compression combustion chamber which is said to give outstanding fuel economy. Other features include variable speed governor control, crankcase ventilation, pressure lubrication, thermo-siphon cooling, and a heavy-duty drop-forged crankshaft statically and dynamically balanced. The Cub is equipped with a three-speed transmission, which provides speeds of two, three and six mph forward, and 2¼ mph in reverse, and a single plate, dry disk clutch of 6½ in. diameter. Specifications follow:

GENERAL:

Maximum belt hp (approx.)	9¼ hp
Maximum drawbar hp (approx.)	8 hp
Forward speeds	2, 3, 6⅛ mph
Reverse speed	2¼ mph
Rear wheel tread, by 4-in. intervals	40 to 56 in.
Front wheel tread, regular	40⅝ and 46⅜ in.
Front wheel tread, adjustable axle, by 4-in. intervals	40⅝ and 56⅝ in.

ENGINE:

Bore and stroke	2⅝ x 2¾ in.
Number of cylinders	4
Piston displacement	59.5 cu in.
Engine rpm, rated full load governed speed	1600 rpm
Crankcase capacity	3 qt
Oil filter	Replaceable paper element
Cooling system capacity	9¾ qt
Ignition	IH Model J-4 Magneto

CHASSIS:

Front tires	3.00-12 or 4.00-12 in.
Rear tires	6-24, 7-24 or 8-24 in.
Steering gear	Enclosed worm
Fuel tank capacity	7½ gal
Air cleaner	4-in. diameter, oil-bath type

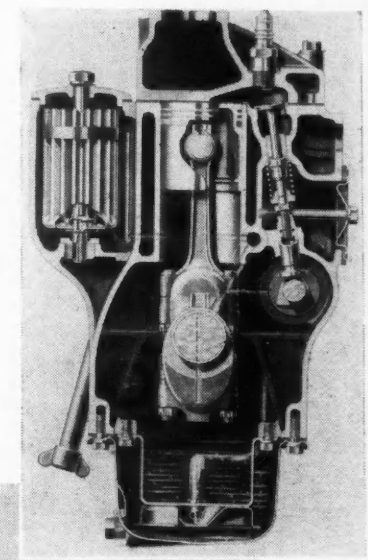
SPECIAL EQUIPMENT:

Power take-off	1600 rpm
Belt pulley	1322 rpm

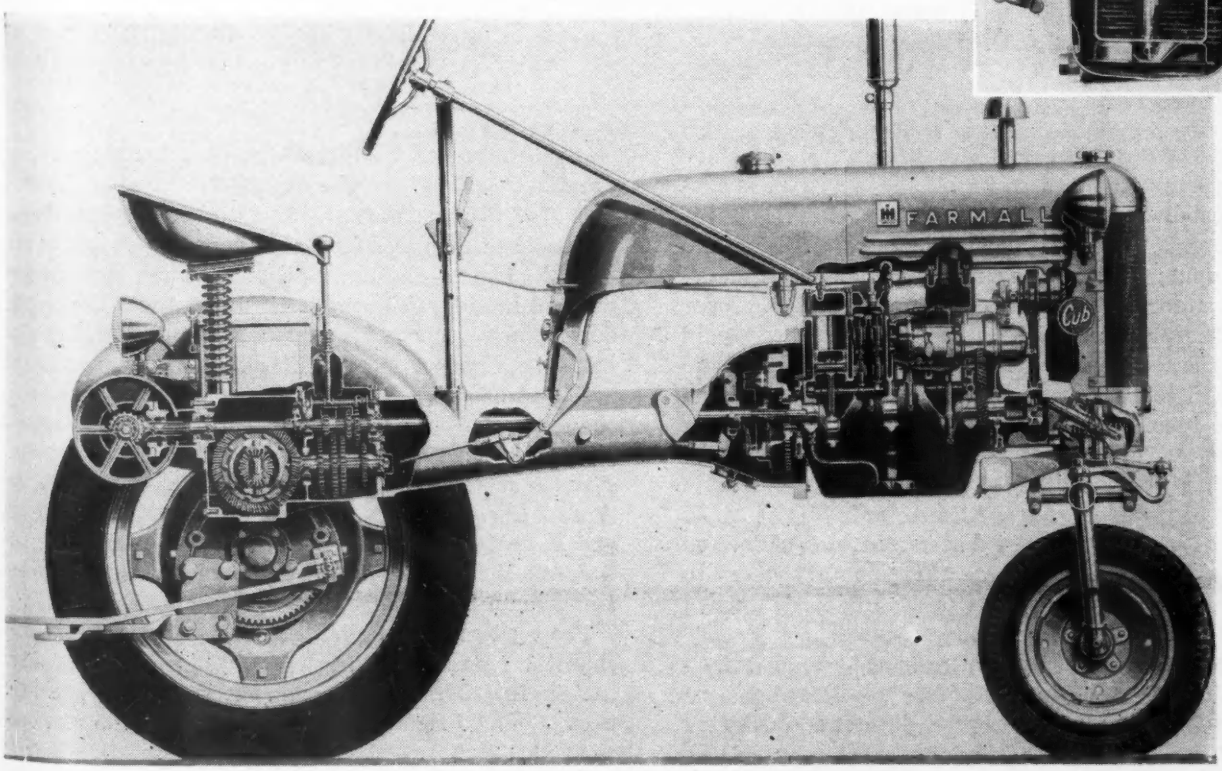
DIMENSIONS AND WEIGHT:

Wheelbase	69⅜ in.
Length	98½ in.
Minimum tread width	47¼ in.
Maximum tread width	63⅜ in.
Shipping weight (less fuel and water)	1140 lb
Shipping weight with adjustable front axle, electric starting and lighting, belt pulley and power take-off, swinging drawbar and exhaust muffler equipment (special)	1310 lb

These specifications are based on 7-24 and 4.00-12-in. tires.



Cutaway drawings of Farmall Cub tractor and its four-cylinder engine



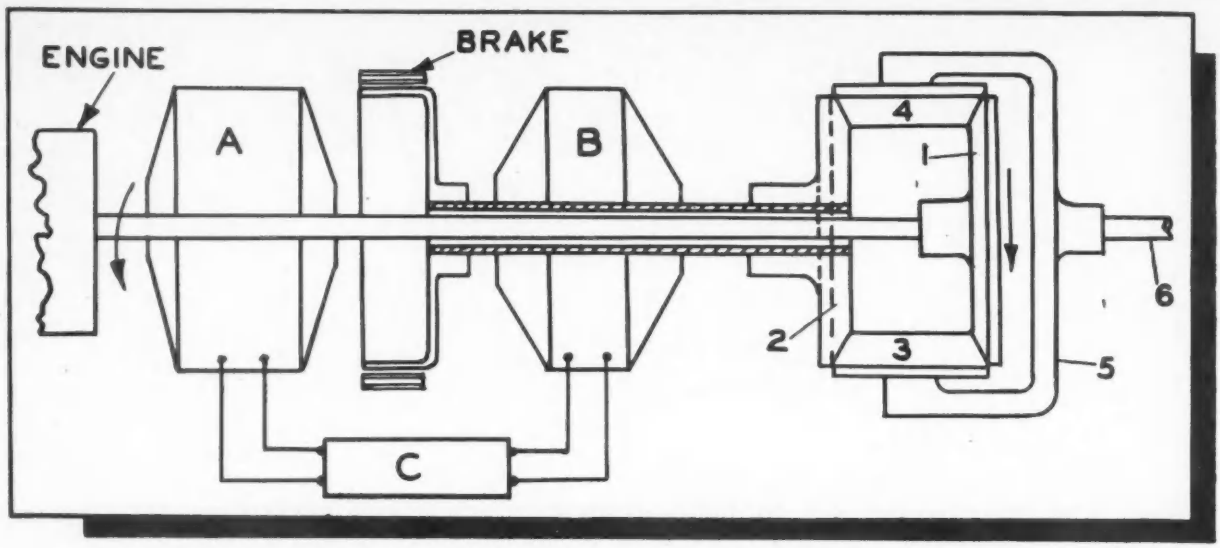


Fig. 3—This drawing shows the simplest form of differential planetary gearing connected to an engine, two electric units, a brake and an electric coordinator which controls the brake. This gear system can operate as a mechanical reduction gear, a regenerative circuit, or a non-regenerative circuit

An Analysis of

Epicyclic Gear Systems For Torque

AN ILLUSTRATIVE form of differential planetary gearing is shown in Fig. 3. This system is connected to an engine and two electric units. These electric units are reversible as to direction and power input; that is, they may be changed from an electric motor to an electric generator at the proper time. Also provided with this system is a brake and an electric coordinator which controls the brake and changes in the electric circuits. For illustrative purposes, it is assumed that the engine and the electric units are 100 per cent efficient. Power is supplied by the engine to turn gear 1. Electric unit *A* is also fastened to the same shaft. Electric unit *B* is fastened to a sleeve concentric to the center shaft and connected to gear 2. Gears 3 and 4 are the planetary gears to turn cage 5 and output shaft 6. A brake is attached to the sleeve on which gear 2 is mounted.

This hypothetical arrangement provides a good illustration of how the simplest planetary gear may be caused to fall under the three different classes of planetary arrangements. Table III illustrates the characteristics of the three different conditions. The table starts with the electric unit *B* turning forward at a fast rate, decreasing in speed to zero and thence increasing in reverse to a high speed as shown in column 2. The engine and unit *A* continue to turn forward at a constant speed of 1000 rpm, with the engine developing a constant torque of 100 lb-ft. The rpm output, column 1, is equal to one-half the sum of the speed of unit *A* and the speed of unit *B*. Column 3, the torque output, is equal to the ratio of engine speed to output speed multiplied by 100; while in columns 4 and 5 are given values of torque developed by units *A* and *B* respectively. The power transmitted by *A* and *B*, columns 6 and 7 respectively, is found by multiplying the unit's speed by the transmitted torque; and column 8 is simply the sum of columns 6 and 7.

The system falls under the first class, a plain mechanical reduction gear, when the brake is applied, the engine turning gear, and electric units are idle. Gear 2 is held fixed, and the planetary cage 5 and output shaft 6 turn at half of engine speed. Gear 2

By A. Y. Dodge
A. Y. Dodge Co.

Part II

Gear Speeds, Torque and Tooth Loads.

Part I was published in the August 1st issue of AUTOMOTIVE INDUSTRIES

Table III Characteristics of Planetary Gear Classes

	1	2	3	4	5	6	7	8
	RPM Output	Variable RPM B	Torque Output	Torque A	Torque B	Power A	Power B	Total Power Through Gears
Non-regenerative Overdrive	+2000	+3000	50	+25	+25	25,000	75,000	100,000
Non-regenerative Overdrive	+1500	+2000	66.6	+33.3	+33.3	66,666	33,333	100,000
Non-regenerative	+1000	+1000	100	+50	+50	5,000	50,000	1000
Non-regenerative	+800	+600	125	+62.5	+62.5	62,500	37,500	1000
Non-regenerative	+600	+200	166.6	+83.3	+83.3	83,300	16,660	1000
Mechanical Reduction	+500	0	200	+100	+100	100,000	0	100,000
Regenerative Forward	+400	−200	250	+125	+125	125,000	25,000	150,000
Regenerative Forward	+200	−800	500	+250	+250	250,000	150,000	400,000
Regenerative Forward	+100	−800	1000	+500	+500	500,000	400,000	900,000
Regenerative Reverse	−100	−1200	−1000	−500	−500	500,000	60,000	1,100,000
Regenerative Reverse	−300	−1600	−333	−166	−166	166,000	266,666	432,666
Regenerative Reverse	−750	−2500	−1333	−66.6	−66.6	66,000	165,000	231,000
Regenerative Reverse	−1000	−3000	−100	−50	−50	50,000	150,000	200,000
Regenerative Reverse	−1500	−4000	−66.6	−33.3	−33.3	33,300	132,000	166,000
Regenerative Reverse	−2500	−6000	−40	−20	−20	20,000	120,000	140,000

e Converters

merely acts as a fixed reactionary member, the brake absorbing the reaction torque which, incidentally, is equal to engine torque under these conditions.

This system becomes a regenerative system when the engine turns in the direction indicated by the arrow, and the gear 2 is permitted or caused to turn in a backwardly direction thereto, turning electric unit *B* which then generates electric current and delivers it to electric unit *A*, which acts as a motor to help turn the engine shaft. This produces a run-around circuit which reoccurs because part of the power delivered to the drive shaft by motor *A* returns to electric unit *B* and back to motor *A* again.

Another regenerative circuit theoretically may be produced as follows: The engine turns its shaft in the direction indicated by the arrow. Unit *A* acts as an electric generator. Unit *B* acts as an electric motor to turn gear 2 in the opposite direction. This will cause the output shaft 6 to turn in the reverse direction since any force delivered to gear 1 by the engine tends to turn gear 2 in the reverse direction, the same direction motor *B* is endeavoring to turn gear 2. Therefore, motor *B*, in order to do any work, will turn gear 2 sufficiently fast so that the action will tend to turn the output shaft in the reverse direction, in which case the gear 1 becomes the reactionary gear turning in the direction of the engine furnishing some of the energy necessary to turn the generator *A*. This is an indirect form of regenerative circuit.

For a non-regenerative system, the engine turns its shaft in the direction indicated by the arrow, and turns gear 1. It also turns electric unit *A* as a generator, generating current which is delivered to unit *B* acting as an electric motor turning in the same direction as the engine, thus turning gear 2 against its reactionary force. In this way, both gear 1 and gear 2 tend to turn the cage 5 and output shaft 6 in the forwardly direction.

Differential Gear Efficiency

Many epicyclic gears mounted on anti-friction bearings have high efficiency due to the low pitch line velocity imposed upon the teeth at the sun gear, and to the complying arcs of contact between the planet gears and the ring gear.

There are only two ways in which shaft power may be lost through a mechanical transmission. One is by loss of speed due to slippage; but since gear teeth cannot slip, there can be no loss by this means through gears. The other source is a torque loss.

In epicyclic gearing, the contact of the teeth is at an angle other than radial, and analysis by a force diagram shows that there is a torque loss due to these contact angles as manifested in gear tooth friction.

Therefore, instead of using a 100 per cent efficiency for the gear chain as was done in the previous examples, a figure of some 98 per cent should be used at those points where torque increase is being secured. However, where the torque ratio is 1 to 1, the deficiency switches over to the other side of the ledger and becomes a credit. Since it is desired to reduce the slip to a minimum, any friction that may exist between the gear teeth helps transmit torque load from the driving to the driven shaft. In other words, if it were possible to introduce a poor lubricant into the gear chain during 1 to 1 torque ratio, the gears themselves would transmit more torque and the fluid turbo would be called upon to transmit less. However, with a ratio where torque increase is to be had, this poor lubricant would interfere with securing the desired torque increase because that portion of torque absorbed in gear tooth friction would be transmitted from the driving to the driven shaft without torque increase. Thus it can be seen that the friction is not a total loss. Merely that percentage of the torque transmitted by gear friction fails to meet with torque increase.

If, for example, the torque ratio were 2 to 1, and if as much as 10 per cent of the input torque were transmitted via gear tooth friction, leaving only 90 lb-ft net, every 100 lb-ft of torque input would give 190 lb-ft torque output or 95 per cent efficiency. Of this 190 lb-ft amount, 180 lb-ft would have resulted via torque increase, and 10 lb-ft through torque transmitted by friction without torque increase; i.e. $(90 \times 2) + (10 \times 1) = 190$.

Much of the figuring heretofore has dealt with turbo units which transmit torque at 1 to 1 as well as at increased torques. Since torque losses are small with this type of gearing, it seems advisable to make the analysis assuming the gears 100 per cent efficient and, if desirable, to make a correction later.

Appendix

List of Symbols

A = Arm or cage
A_{rev} = Arm revolutions
a = Radius of cage or arm
K = Torque of driven member of variable unit divided by torque of driving member of variable unit
M = Mechanical advantage of gear or gear ratio
P = Planet gear
p = Planet gear radius
R = Ring gear
R_d = Ring gear diameter
R_{rev} = Ring gear revolutions
S_d = Sun gear diameter
S_{rev} = Sun gear revolutions
s = Sun gear radius
Tq = Torque

The formulae given below are all applicable to both the internal epicyclic gears shown in Figs. 4 and 5.

The following fifteen formulae apply to both regenerative and non-regenerative arrangements.

$$Out\ Tq = Eng\ Tq + Stat\ Tq$$
$$Out\ Tq = Rot\ Tq + Sun\ Tq$$
$$Out\ Tq = Imp\ Tq + Sun\ Tq + Stat\ Tq$$
$$Rot\ Tq = Imp\ Tq \times K$$
$$Rot\ Tq = Imp\ Tq + Stat\ Tq$$
$$Rot\ Tq + Sun\ Tq = Eng\ Tq + Stat\ Tq$$
$$Rot\ Tq = Out\ Tq \times \frac{M-1}{M}$$
$$Eng\ Tq = \left(\frac{M-1}{K} + 1\right) Sun\ Tq$$
$$Eng\ Tq = Sun\ Tq + Imp\ Tq$$
$$Stat\ Tq = Out\ Tq - Eng\ Tq$$
$$Stat\ Tq = Rot\ Tq - Imp\ Tq$$
$$Sun\ Tq = Out\ Tq - Rot\ Tq$$
$$Imp\ Tq = Eng\ Tq - Sun\ Tq$$
$$Imp\ Tq = Sun\ Tq \times \frac{M-1}{K}$$
$$K = \frac{Rot\ Tq}{Imp\ Tq}$$

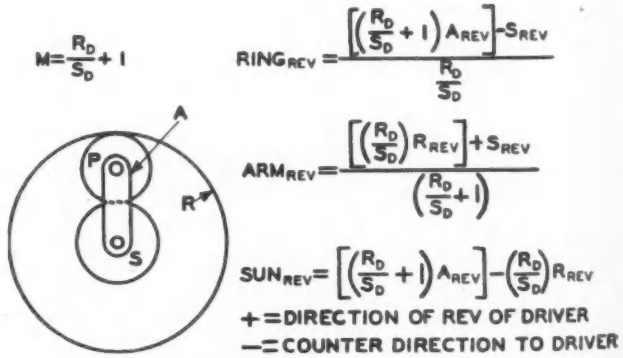
The following four formulae apply to regenerative arrangements only.

$$Rot\ Tq = Out\ Tq \left(\frac{M}{M-1}\right)$$
$$-Sun\ Tq = \frac{Out\ Tq}{M-1}$$
$$-Sun\ Tq = \frac{Rot\ Tq}{M}$$
$$Imp\ Tq = Eng\ Tq - Sun\ Tq \text{ (minus a minus)}$$

The following three formulae apply to non-regenerative arrangements only.

$$Sun\ Tq = \frac{Rot\ Tq}{M-1}$$
$$Sun\ Tq = \frac{Out\ Tq}{M}$$
$$Imp\ Tq = \frac{Sun\ Tq \times (M-1)}{K}$$

Fig. 4



Non-Regenerative Formulae For Gear in Fig. 4

$Rot\ Tq = Ring\ Tq$

C = Cage — Driven or output member
S = Sun — Input from engine
R = Ring — Input from variable device

Regenerative Formulae For Gear in Fig. 4

$Ring\ Tq = Sun\ Tq \times (M-1)$

R = Ring — Driven or output member
C = Cage — Input from variable device
S = Sun — Driven by reaction in a forward direction it helps turn the impeller, therefore is a negative torque.

Fig. 5

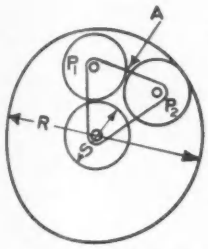
$$M=\frac{R_D}{S_D}$$

$$\text{RING}_{REV}=\frac{S_D}{R_D}\text{SUN}_{REV}+\left(1-\frac{S_D}{R_D}\right)\text{ARM}_{REV}$$

$$\text{ARM}_{REV}=\frac{\text{RING}_{REV}-\left(\frac{S_D}{R_D}\times\text{SUN}_{REV}\right)}{1-\frac{S_D}{R_D}}$$

$$\text{SUN}_{REV}=\left[R_{REV}-\left(\left(1-\frac{S_D}{R_D}\right)A_{REV}\right)\right]\times\frac{R_D}{S_D}$$

+=DIRECTION OF REV OF DRIVER
−=COUNTER DIRECTION TO DRIVER



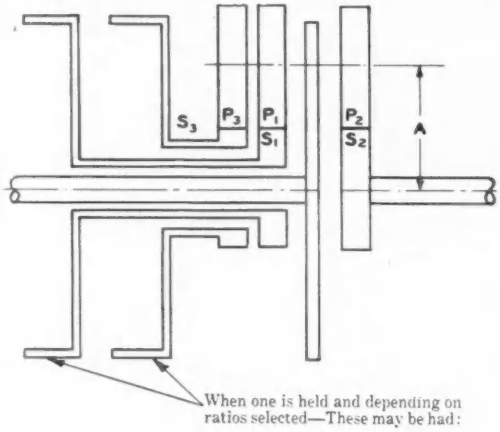
Non-Regenerative Formulae For Gear in Fig. 5

Rot Tq = *Cage Tq*
R = Ring — Driven or output member
S = Sun — Input from engine
C = Cage — Input from variable device

Regenerative Formulae For Gear in Fig. 5

Rot Tq = *Ring Tq*
C = Cage — Driven or output member
R = Ring — Diven by variable speed device
S = Sun — Driven by reaction in a forward direction it helps turn the impeller, therefore is a negative torque.

Cage Driving or Cage Driven



When one is held and depending on ratios selected—These may be had:

1. Reverse under-drive, or
2. Reverse over-drive, or
3. Forward under-drive, or
4. Forward over-drive

In formulas S_3 indicates the fixed sun, S_1 the driving sun. Known —

$$\text{Output } Tq = \text{Reactance } Tq \pm \text{Input } Tq \begin{pmatrix} + = \text{Forward} \\ - = \text{Reverse} \end{pmatrix}$$

Reactance Tq = Output Tq − Input Tq (For forward)
Reactance Tq = Output Tq + Input Tq (For reverse)

Let X = Counter-clockwise (or +) bearing loads on planet bearings. Let Y = Clockwise (or −) bearing loads on planet bearings. Bearing loads are equal to the tangential force at pitch line, i.e., tooth load. Then:

Cage or Arm $Tq = (X \pm Y)$ radius of arm

The original tooth load may be considered one lb in any of the formulas, to secure ratios.

$$Tq \text{ input} = \begin{cases} 1.\ s_1 \times \text{tooth load (If } S_1 \text{ is driving)} \\ 2.\ a\,(X \pm Y) \quad \text{(If arm is driving)} \\ 3.\ a\left(1 \pm \frac{p_2}{p_3}\right) \text{(If } S_3 \text{ is fixed and arm is driving)} \end{cases}$$

$$Tq \text{ output} = \begin{cases} 1.\ s_1 \times \text{tooth load (If } S_1 \text{ is driven)} \\ 2.\ a\,(X \pm Y) \quad \text{(If arm is driven)} \\ 3.\ a\left(1 \pm \frac{p_1}{p_3}\right) \text{(If } S_3 \text{ is fixed and arm is driven)} \end{cases}$$

When tooth load on output S_2 or P_2 equals one lb, then

$$\text{Tooth load on } P_3 = \frac{1 \text{ lb} \times p_2}{p_3} = \frac{p_2}{p_3} \qquad (A \text{ Driving})$$

$$\text{Tooth load on } P_1 = \frac{1 \text{ lb} \times p_2}{p_1} = \frac{p_2}{p_1} \qquad (A \text{ Driving})$$

$$\text{Reaction } Tq \text{ on } S_3 = \frac{p_2 \times s_3}{p_3} \qquad (A \text{ Driving})$$

$$\frac{S_{1\,rev}}{A_{rev}} = 1 - \frac{p_1 \times s_3}{p_3 \times s_1} \text{ when } (S_{3\,rev} = 0)$$

$$A_{rev} = S_{1\,rev} \div \left(1 - \frac{p_1 \times s_3}{p_3 \times s_1}\right) \text{ when } (S_{3\,rev} = 0)$$

$$S_{1\,rev} = A_{rev}\left(1 - \frac{p_1 \times s_3}{p_3 \times s_1}\right) \text{ when } (S_{3\,rev} = 0)$$

The revolution of A is in the same direction as S_1 when the above values are plus and opposite when they are minus.

$$P_{1\,rev} = \frac{s_1}{p_1}(S_{1\,rev} - A_{rev})$$

$$P_{1\,rev} = A_{rev}\left(1 + \frac{s}{p}\right) \text{ If } S_{1\,rev} = 0$$

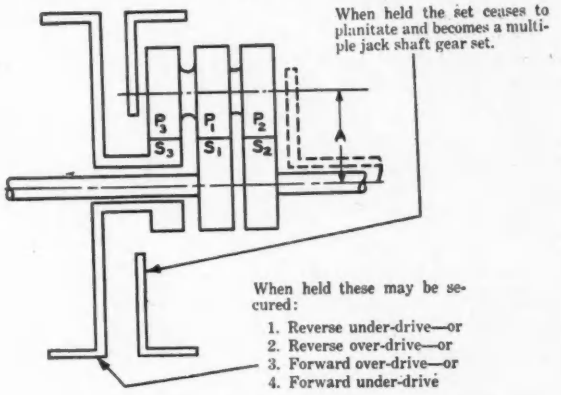
Two sun gears and an arm formula may be used for all three suns turning or one turning zero rev. (S_2 and P_2 may be substituted for S_3 and P_2 when S_1 and S_2 are the ones involved).

$$A_{rev} = \frac{S_{1\,rev}}{\left(1 - \frac{p_1 \times s_3}{p_3 \times s_1}\right)} + \frac{S_{3\,rev}}{\left(1 - \frac{p_3 \times s_1}{p_1 \times s_3}\right)}$$

$$S_{2\,rev} = \left(A_{rev} - \frac{S_{1\,rev}}{\left(1 - \frac{p_1 \times s_2}{p_2 \times s_1}\right)}\right)\left(1 - \frac{p_2 \times s_1}{p_1 \times s_2}\right)$$

$$S_{1\,rev} = \left(A_{rev} - \frac{S_{2\,rev}}{\left(1 - \frac{p_2 \times s_1}{p_1 \times s_2}\right)}\right)\left(1 - \frac{p_1 \times s_2}{p_2 \times s_1}\right)$$

Sun Gears Driving and Driven



$$Tq \text{ input} = \begin{cases} a\left(1 \pm \frac{p_2}{p_3}\right) A \text{ driving, } S_2 \text{ driven, } S_3 \text{ fixed} \\ \text{Driving } s \times \text{tooth load (If sun is driving)} \end{cases}$$

$$Tq \text{ output} = \begin{cases} 1.\ \text{Driven } s \times \text{tooth load (If sun is driven)} \\ 2.\ \text{Driven } a\ (X \pm Y) \\ 3.\ a\left(1 \pm \frac{p_1}{p_3}\right) S_3 \text{ fixed, } S_1 \text{ driving} \end{cases}$$

The revolution of A is in the same direction as S_1 when the above valves are + and opposite when −.

Three sun gears all turning (one may turn zero rev).

$$S_{2\,rev} = \frac{S_{1\,rev}}{\frac{s_2}{s_1}\left(-\frac{s_3 - s_1}{s_2 - s_3}\right)} + \frac{^*S_{3\,rev}}{\frac{s_2}{s_3}\left(-\frac{s_3 - s_1}{s_1 - s_2}\right)}$$

$$S_{1\,rev} = \left(S_{2\,rev} - \frac{^*S_{3\,rev}}{\frac{s_2}{s_3}\left(-\frac{s_3 - s_1}{s_1 - s_2}\right)}\right)\left(\frac{s_2}{s_1}\left[-\frac{s_3 - s_1}{s_2 - s_3}\right]\right)$$

$$S_{3\,rev} = \left(^*+S_{2\,rev} - \frac{^*S_{1\,rev}}{\frac{s_2}{s_1}\left(-\frac{s_3 - s_1}{s_2 - s_3}\right)}\right)\left(\frac{s_2}{s_3}\left[-\frac{s_3 - s_1}{s_1 - s_2}\right]\right)$$

* Change signs according to rule above.

Observations

by Joseph Geschelin

Roadable Airplanes

A PROMINENT air-cooled engine builder confirms the remarks that appeared in OBSERVATIONS recently regarding development of roadable airplanes. He mentions work in progress currently to adapt one of their engines to a vehicle of this character. One design under study contemplates the installation of a small auxiliary engine of say 20 hp for driving the vehicle on the ground. But this does not appear practical since few motorists would be satisfied with the consequent performance on the ground. Our correspondent suggests the feasibility of developing a dual induction system for the airplane engine—a wide open system to give maximum power while in the air; and another system of smaller cross-section and higher velocity for ground operation. Use of close fitting pistons to eliminate piston slap; properly designed timing gears; and the adoption of hydraulic valve lifters can be combined to yield satisfactory quietness.

Soaking the Diesel

AS OF July 1 the state of Michigan enacted a new law taxing gasoline and Diesel fuel used in motorboats. On gasoline the tax is three cents a gallon for boats over 16 feet long. Diesel power gets special treatment to the tune of five cents per gallon and the tax is imposed on the user. This reminds us of what was said many years ago—that taxation in the long run will tend to level at least part of the fuel saving offered by the more economical Diesel engine. Of course the Diesel still enjoys the advantage of burning a safety fuel, a feature of vital importance to those who take to the water.

Improving Fastenings

THE tacking of headlinings and upholstery in passenger car bodies is an old art stemming from the carriage age. The use of tacks is an art quite difficult to acquire, considering the speed necessary in mass production. One of the body builders is experimenting with the conventional hand stapler in an effort at improvement. And why not. Staplers have been used for some years to affix bulletins on boards, and fabrics and plastic sheets onto boards of various kinds. This development will bear watching.

Good Housekeeping

IT IS a pleasant experience to walk through the new or modernized plants of the industry. For these plants express the essence of good housekeeping—adequate lighting, clean paint on walls and ceilings, clean machines, clean floors. Management recognizes the value of good housekeeping in encouraging accurate work. On the other hand there are still some plants that have not caught up with the modern trend. Machinery much the worse for wear and ugly in appearance, begrimed walls and ceilings, and old fashioned ceiling lights of a by-gone era. Such surroundings are neither conducive to good work nor an incentive to worker morale. Certainly the workers and inspectors cannot do a good job without the best of lighting and housekeeping.

Turn Mill

ONE of the prominent machine tool builders has just installed the first two machines of an advanced type of crankshaft pin and cheeking turn-miller. Using a master cam for indexing the work and two large turn-milling cutters synchronized with the master cam, the machine finishes a pair of pins at a time and completes a shaft in one setting automatically. The master mechanic in this plant told us that this one machine equals the output of three of their conventional machines and saves a corresponding amount of floor space. Outstanding feature of the machine is its flexibility. For it is feasible to handle a wide range of shafts over the same machine in lots, simply by changing master cams, cutters, and the camming adjustment for the cutter heads. We are told that this type of machine can be built for single-purpose set-ups with additional heads capable of machining all pins and cheeks practically simultaneously.

35 Per Cent 10 Years Old

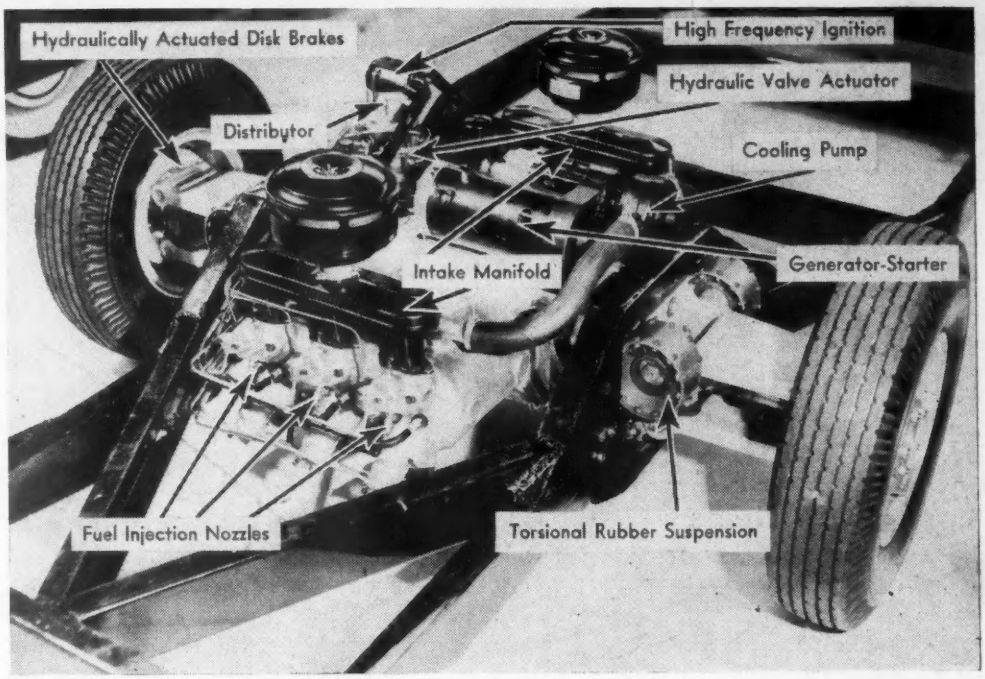
ACCORDING to the current edition of the familiar AMA "Facts and Figures," of the cars now registered only six per cent are less than five years old, 59 per cent are five to nine years old, and 35 per cent are 10 years old or more. The statistics prove that motor cars can be run longer than anyone had anticipated. Part of the increase in population of old cars can be credited to a decrease in scrappage owing to lack of new cars. According to "Facts and Figures" vehicle scrappage is 40 per cent of the 1937-41 rate. While one can take considerable pride in the longevity of modern motor cars, the situation is fraught with serious problems. For one thing too many cars are in bad shape mechanically. Availability of spare parts and freeing of service facilities should prove beneficial provided the owners can be induced to make the necessary overhauls on cars ready for the junk pile. Meanwhile the auto insurance rate has soared and is becoming almost prohibitive on certain coverages.

Traffic Fatalities

AMA "FACTS AND FIGURES" has an interesting chart showing that the traffic fatality rate is three times greater at night. Here is tangible reason for the effort in recent years to improve night driving. It sheds light on the work being done by the industry in its investigation of Polaroid lighting. Whatever is done must assure a higher level of illumination on the highway without glare. Of course the other solution is one that public authorities refuse to consider—namely the lighting of the highway itself to give daylight driving conditions. It can be done with the new and improved lighting sources that are available. Moreover, the cost would not be prohibitive since only a small percentage of highways—those most heavily traveled—require this treatment.

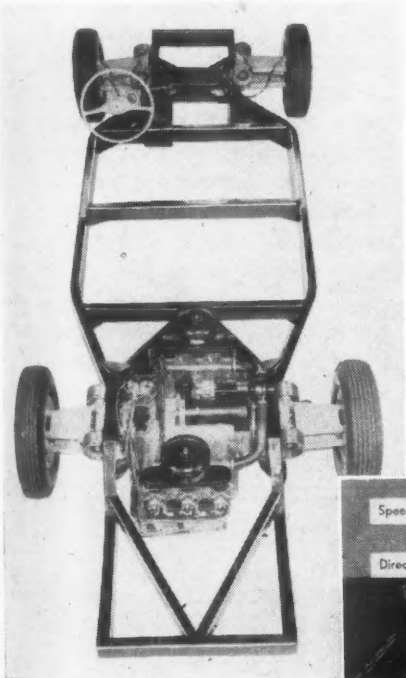
Valve Trouble

DURING the war we had occasion to comment on intake valve troubles in truck service—burning and sticking and gunking. Some users thought it was due to the fuel; others had other explanations. We never did learn what caused the trouble. In fact, we assumed that intake valve failures had disappeared. Now we find that operators are experiencing trouble both with intake and exhaust valves. Whatever the reason some of the heavy duty engine builders have been engaged in the problem and are trying to find some palliative through design changes.

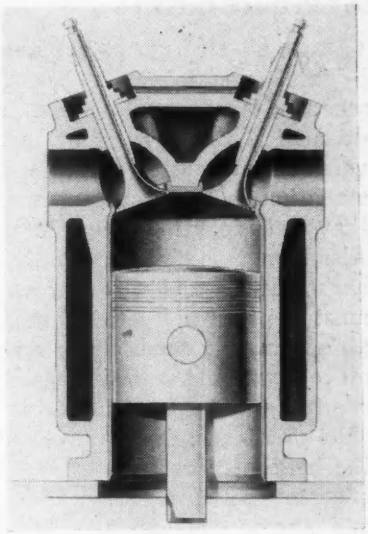


Closeup of the horizontally-opposed six-cylinder engine which has a hydraulic drive system at each end of the crankshaft. It also gives a good view of the rear independent suspension system with rubber units mounted at each side of the upper arms. The engine has five by five in. bore and stroke, displacement of 589 cu in. and output of 150 hp.

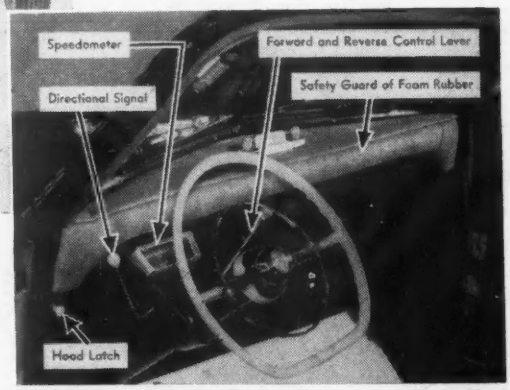
Tucker Innovations



(Left) This view shows the general construction of the Tucker chassis with rear-mounted engine (see Automotive Industries of Feb. 1, page 50). The frame, which consists mostly of two by five in. channels, incorporates five cross members and four torsional members, two of which are located just ahead of the engine. General data on the car have been announced as follows: Wheelbase — 128 in.; overall length—214 in.; front tread—62 in.; rear tread—65 in.; maximum car width—76 in.; height fully loaded — 76 in.; weight (empty) — nearly 3000 lb.



(Top) Sectional view of Tucker engine cylinder to show mounting of hydraulically-actuated valves, cooling jackets and cylinder lining. The engine has two banks of three cylinders made of aluminum alloy as are the pistons. The blind end bores are to be sprayed with an aluminum bronze alloy and finished by diamond boring after a preliminary rough boring.



(Bottom Left) In the front compartment the absence of the conventional instrument panel is conspicuous. The speedometer is built into the steering column support.

Recent Developments

Helicopter Power Plant Installations

By Robert A. Wolf,
Helicopter Design Engineer,
and
Carl P. Spiesz,
Power Plant Group Engineer,
Bell Aircraft Corp.

Engine Cooling

SINCE all aircraft piston engines are essentially air cooled, whether labelled so or not, large quantities of air must be maneuvered in and out of the engine installation in the proper manner so that heat is carried away efficiently. Also numerous air inlets, engine exhaust outlets, and oil cooler outlets must be properly located so that hot air exhausting from either engine, oil cooler, or exhaust systems is not drawn into nearby cold air inlets. This presents a unique problem on the helicopter because of the lack of ram pressure during hovering and due to the eccentric air flow patterns characteristic of rotary wing craft.

Typical flow patterns are illustrated in Fig. 1. In the hovering condition, which is most critical from a cooling standpoint, there is a definite change of air flow direction about the body depending upon whether the ship is on the ground or high enough away from the ground to be out of the so called "ground effect." When the ship is very near the ground, the general air flow near the center of the rotor is upward due to a reflection pattern. However, when the ship is high enough to minimize the reflection pattern the flow reverses and is generally downward. The other condition is that encountered in forward flight. Here the pattern is essentially horizontal with flow toward the rear. The major component of flow is due to forward speed as the rotor down wash is comparatively small. These three patterns should be thoroughly considered when locating air inlets and outlets, especially from the re-circulation standpoint.

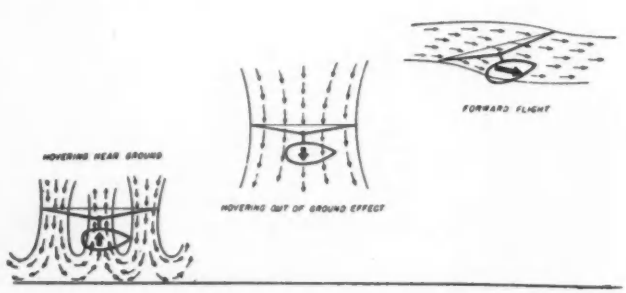
Since the engine must be cooled by means other than ram pressure, the cooling air inlet need not be of the ram type; however, it is desirable to utilize the available velocity head of forward flight if it can be done at an efficiency equal to or better than that of the cooling fan. If the efficiency of the ram inlet and ducting is high enough there will be a saving of power going into cooling which can be diverted to the rotor. The choice of its use depends on the designer and the type of power plant installation under consideration.

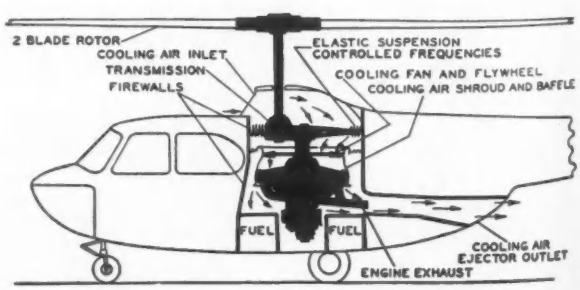
The helicopter engine can be cooled by either a fan or an ejector, or any combination of these. Perhaps the most common is the use of a fan directly driven by the engine and located on the "cold" side of the cylinders. This arrangement has proved satisfactory in many airplane installations and has a unique feature as applied to the helicopter since it also serves as a flywheel. This feature sets up new requirements for fan design since the fan disc, blades and attachment to the crankshaft must be designed for rather violent torsional accelerations encountered in starting the engine and must also be able to "take" the roughness encountered in idling. The inertia of the fan must be adequate to provide satisfactory idling characteristics of the engine, since the rotor is not engaged during the starting and

(*Turn to page* 58, *please*)

Fig. 1—(Bottom left) Typical airflow patterns around the helicopter

Fig. 2—(Bottom right) This drawing shows the flexible pylon suspension installation of the Bell model 42





in Helicopter Power Plants

A summary of latest advances in engine design of rotary wing aircraft—cooling by exhaust ejectors—suspension systems —specific weight reduction—as abstracted from two papers recently presented before national meetings of the SAE.

Problems of Helicopter Power Plants

By Robert Insley,
Vice President-Chief Engineer,
Continental Motors Corp.

Specific Weight

IN HELICOPTER power plants, reduction in structural weight is accomplished by the use of lighter materials and by more extensive machining of parts. The best opportunity for such reduction with minimum increase in cost lies in the substitution of magnesium for aluminum, especially in crankcase and accessory case castings. By such means, it is possible to equal or surpass the service strength of aluminum and save nearly a third of the weight of the part. Thus, in a crankcase for an engine of 250 hp, a reduction of approximately 20 lb can be produced by the use of magnesium with no sacrifice in strength and at little, if any, increase in cost. Weight reduction by more extensive machining, however, and by the use of lightening holes and scallops comes high in price and must be scrutinized carefully to weight cost against benefits.

What can be accomplished practically by these methods without basic structural alteration is illustrated by the following comparison of the Continental 0-470 helicopter engine and the Continental E-185 airplane engine. The two engines are identical in fundamental structure, but the 0-470 engine employs magnesium wherever possible and is operated at a crankshaft speed of 3200 rpm. Weight comparisons are of engines in similar condition (without fans) in the table on this page.

	P-470	*E-185*
Bore, in.	5	5
Stroke, in.	4	4
Piston displacement, cu in.	472	472
Rated power (gross)	270	185
Rated speed, rpm	3200	2300
Bare weight, lb	304	340
Lb per cu in. displacement	0.645	0.720
Lb per hp	1.111	1.840

Engine Configuration

Because of its inherent lightness, the radial engine must have favorable consideration for rotary wing use. Several such engines—notably the Pratt and Whitney Wasp Jr., the Warner and the Continental R975—have been used successfully. The form of the radial engine favors a simple cooling fan installation, although the same dimensional characteristics make it clumsy to install, especially with vertical crankshaft in small helicopters. However, in larger helicopters, where installation space is not so restricted, the favorable weight and dimensional characteristics of the radial engine seem likely to indicate its use at least until the turbine finds its way into this service. In current small helicopters the preference has gone to the opposed type of engine, not because of any inherent superiority, but principally on the basis of availability and the willingness of the proponents to cooperate in helicopter programs.

A very prominent trend, particularly in single engine helicopters

(*Turn to page* 76, *please*)

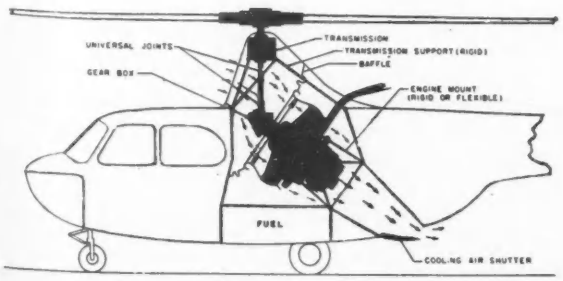
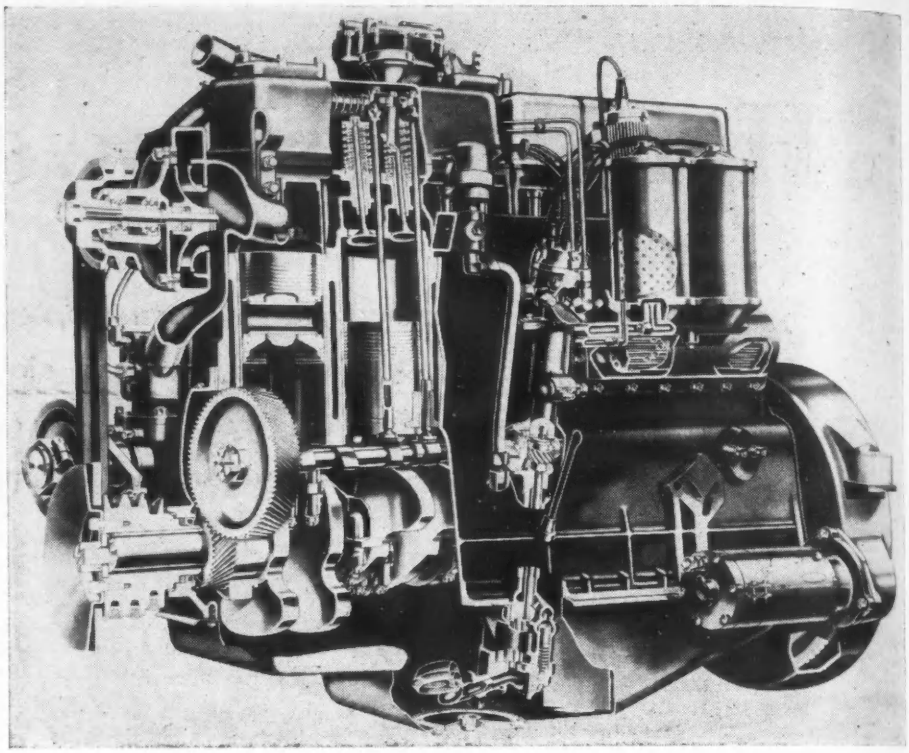


Fig. 3—Rigid pylon type of suspension system



Cut-away drawing of the International-Continental S-6749 engine.

International-Continental

Western Model

ALTHOUGH the International-Continental model S-6749 engine has been offered for some time as standard equipment on International Harvester Co.'s Western or "W" models (described in Feb. 1, 1947, issue of AUTOMOTIVE INDUSTRIES), full details of this six-cylinder overhead-valve engine have just recently been released. The S-6749 has a displacement of 749 cu in., and develops 246 hp (gross) at 2600 rpm. General specifications are given in the accompanying table.

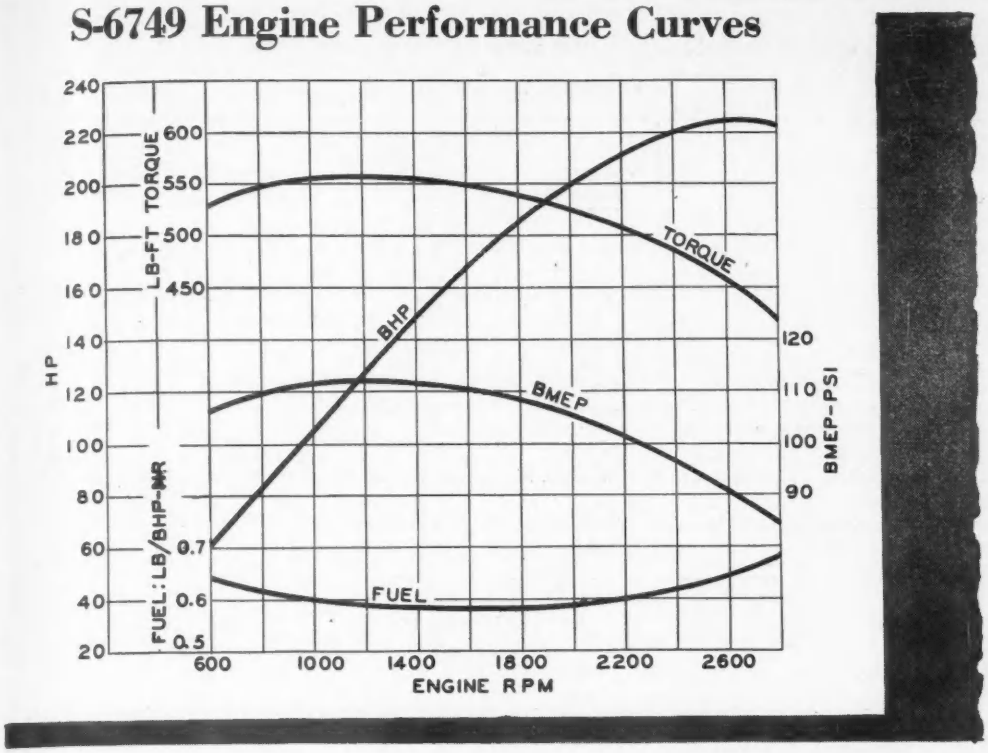
Basic design of this engine, accenting clean-cut appearance with simplicity of servicing, stems from experience gained during the war. The cylinder block is a one-piece casting integral with the crankcase, which is heavily ribbed to prevent distortion and reduce vibration. Cylinder bores are machined to take dry liners. Alloy cast-iron is used for both the block and liners. The liners have an exceptionally high hardness, 444 to 555 Brinell, for long life. Cylinder heads are of dual design, and are held in place by 28 heat treated cap screws. The combustion chamber is of improved design with provision to adapt the compression ratio to changes in octane rating of standard gasolines.

The heavy-duty counterbalanced crankshaft, which rotates on seven main bearings, is statically and dynamically balanced to ½ oz-in. Torsional vibra-

General Specifications of the S-6749 Engine

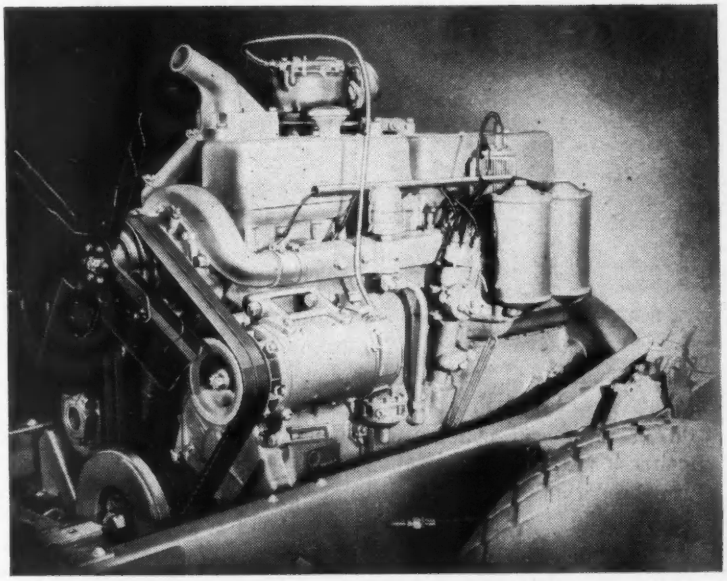
Type	Six-cylinder, valve-in-head
Bore	5⅜ in.
Stroke	5½ in.
Displacement	748.8 cu in.
Compression ratio	6 to 1
Power (gross)	246 hp at 2600 rpm
Maximum torque (gross)	576 lb-ft at 1250 rpm
Crankcase capacity	18 qt

S-6749 Engine Performance Curves



These performance curves of the S-6749 engine show its net output with water pump, fan, governor, air cleaner, generator, muffler and tail pipe.

Engine



Three-quarter front view of the S-6749.

tion is held to a minimum by the use of a vibration damper of bonded rubber-metal.

The camshaft is a one-piece drop forging integral with oil pump and distributor shaft drive gears. The five camshaft bearings are of steel-back, babbitt-lined, replaceable precision type. Main and connecting rod bearings are Tri-metal, heavy-duty, replaceable precision type. Piston pin bushings are of phosphor-bronze.

The intake-manifold, a down-draft type with individual porting, includes a suitable hot-spot to ensure satisfactory warm-up. The exhaust manifold is of three-section design with a center down-take outlet.

Pistons are cam-ground aluminum alloy castings with five rings: two oil rings and three taper-faced compression rings. They are both oval and taper ground and have a solid skirt. The piston pin "floats" both in the connecting rod and piston, and is held in place by two spring steel retainers which lock into grooves machined in the piston at each end of the piston pin, which is 1¾ in. in diameter.

Intake valves are made of No. 1 Silchrome, are large size, and have a 30-deg seat angle. Intake valve seats are machined in the head since the valves run fairly cool owing to the washing effect of the incoming charge of fuel. Exhaust valves are made of TPA steel with a Stellite face, and are sodium cooled. In addition, the heads are Brite-Ray treated to prevent lead pitting. Exhaust valves are fitted with the Roto-Valve mechanism which acts to rotate the valve each time it lifts. Stellite-faced exhaust-valve seats also are provided. Dual valve springs, inner and outer, are used, both being cadmium plated to increase life.

Table 1—Consumer Intentions to Buy in 1946 and 1947 and Actual Purchases in 1946[1]

Type of purchase	Percentage of spending units	Estimated number of spending units (In millions)	Average price	Estimated total expenditures (In billions)
Automobiles:				
Purchases planned, 1946—total	9.6–12.2	4.4– 5.6	$1,100	$ 4.8– $ 6.2
New cars	7.4– 9.3	3.4– 4.3	[2]	[2]
Used cars	2.2– 2.9	1.0– 1.3	[2]	[2]
Actual purchases, 1946—total	10.6	[3]5.0	920	4.6
New cars	3.3	1.5	1,620	2.3
Used cars	7.4	3.5	630	2.3
Purchases planned, 1947—total	10.4–13.4	4.6– 6.2	1,300	6.0– 8.1
New cars	7.3– 9.7	3.4– 4.5	1,540	5.2– 7.0
Used cars	2.7– 3.7	1.2– 1.7	650	.8– 1.1

[1] Intended purchases for the year 1946 were ascertained in the first survey made early in 1946. Actual purchases during 1946 and intended purchases for 1947 were ascertained in the second survey, early in 1947. In each case where a range is presented the bottom of the range includes all those who said definitely they would buy and one-half of those who said they probably would buy but might not. The top of the range includes all those who said they definitely or probably would buy, and one-half of those who said they were undecided. The distribution of spending units by intentions to buy, 1946 and 1947, is shown in supplementary Table 11 following the text of this article.

[2] Data not available.

[3] This figure represents the number of cars bought, not the number of spending units that bought cars. The 5 million cars were bought by 4.9 million spending units—a few spending units bought more than one car.

What Is the Actual Demand

ABOUT four million spending units are prospective buyers of automobiles during 1947 according to consumer intentions expressed at the beginning of 1947. This and other interesting disclosures regarding purchases of consumer durable goods and houses in 1946; plans to purchase such items in 1947; how consumers financed these purchases in 1946 and plan to finance their purchases in 1947; uses of liquid assets in 1946 and many other items are the results of a survey conducted for the Federal Reserve Board by the Survey Research Center of the University of Michigan. An abstract of that portion of this article, "Survey of Consumer Finances, Part I. Expenditures for Durable Goods and Investments," pertaining to the purchases of new and used automobiles follows.

IN the automobile industry it is generally regarded that the tremendous potential demand in this country for passenger cars has not fallen off. So, in appraising this Federal Reserve Board survey with respect to market depth, it is well to consider that although it indicates how many people plan to buy cars this year, this group does not comprise the entire backlog, since millions in addition would buy if they could get some assurance of delivery, manufacturers point out. One company says that its backlog of unfilled orders and potential orders is as great, if not greater than it was a year ago. Another manufacturer points out the difficulty of keeping up with its backlog of orders. Of these two companies, each have about 1.7 million orders unfilled, so it can be seen that the automobile industry has a huge stockpile of actual orders for cars, even discounting the orders 25 per cent.—Ed.

Approximately 3000 interviews were taken in 66 areas distributed over the nation. Different samples, each representing a cross-section of the nation's consumers, were used in the first such survey conducted in 1946 and the second such survey in 1947. The interview unit was the consumer spending unit, defined as all persons living in the same dwelling and belonging to the same family who pooled their income to meet their major expenses. The technique of the sample survey used in 1946 and again in 1947 is a development of relatively recent years and the significance of the findings is particularly difficult to

Table 2—Distribution of Consumer Intentions to Buy in 1946 and 1947 and of Actual Purchasers in 1946 by Income Group of Purchaser

Type of purchase	Prospective and actual purchasers as a percentage of all units within each income class					
	All income groups	Less than $1,000	$1,000–$1,999	$2,000–$2,999	$3,000–$4,999	$5,000 and over
Automobiles:						
Expected to buy in 1946	11	3	8	11	16	26
Bought in 1946	11	2	9	13	11	20
Plan to buy in 1947	12	4	6	12	18	24

Table 3—Method of Payment for Automobiles and Other Selected Durable Goods by Prospective and Actual Buyers, 1946 and 1947

Method of payment	Percentage distribution of buyers		
	Plans for financing in 1946	Actual financing in 1946	Plans for financing in 1947[1]
Full cash (including trade-in allowances)	56	66	55
Installment credit (together with down payments—cash and trade-in allowances)	35	32	37
Uncertain as to method	9	2	8
All buyers	100	100	100

[1] Distribution of buyers of automobiles and of buyers of other selected durable goods by methods of payment for 1947 are substantially similar.

d for Cars?

Basing Its Conclusions on National Survey Conducted by Survey Research Center of University of Michigan, Federal Reserve Board Finds Slightly Above Normal Demand Exists This Year

assess because similar information has not been available in the past. The availability of the 1946 survey results greatly enhances the usefulness and meaning of this year's survey, but the need for caution in interpreting the survey findings continues to merit strong emphasis. Results of similar surveys for more years would be useful in evaluating results.

According to consumer intentions expressed at the beginning of 1947 about four million spending units are prospective buyers of new passenger automobiles in 1947. It thus appears that consumer demands for new automobiles will likely absorb all of the new cars produced for domestic use. Last year a similar number expected to buy new cars, but only about two million were produced and roughly three-fourths of these, after allowances for sales to businesses and governments and for export, were distributed to domestic consumer markets; consequently, consumers were unable to buy as many new cars as they planned.

In 1946 three times as many consumers bought used cars as expected to do so at the beginning of the year — many people who had expected to buy new cars evidently shifted to used cars, and many who had not expected to buy at all bought used cars. Purchase of used cars is subject to many influences which are not allowed for in planning. Damage in accidents or unexpectedly heavy repair bills may bring about unforeseen purchases. While an estimated 1.5 million planned to buy used cars in 1947, or few more than intended to buy in 1946, it may be safely assumed that the number of used cars bought in 1947 will be much greater than that total. In Table 1 will be

Table 4—Consumer Attitudes Toward Selected Purchases in 1946 and 1947

Type of product and attitude toward purchase	Percentage distribution of all spending units	
	1946	1947
Automobiles:		
Will buy	8	8
Will probably buy	3	4
Undecided, "it depends"	2	3
Will not buy	84	84
Not ascertained	3	1
All cases	100	100

found a summary of Consumer Intentions to Buy in 1946 and 1947 and Actual Purchases in 1946.

While the people with incomes of under $3000 bought as many automobiles as they had planned to buy in 1946, the upper income groups did not fully carry out their buying intentions. This comparison is given in Table 2. Probably many of these people preferred to wait until they could get new cars; their deferred demand is being carried over into the current year. In 1947 it may be anticipated that more spending units in all income groups will buy automobiles (new and used cars together) than actually planned to do so at the beginning of the year.

The market for cars (new and used considered together) falls chiefly in the $1000-$5000 income brackets. As shown in the chart, spending units with incomes of under $1000 make up 17 per cent of the spending units, but include only three per cent of the people who bought automobiles in 1946 and only one per cent of the amount spent for automobiles. The spending units with incomes of $5000 or more, or 10 per cent of all spending units, bought 18 per cent of the cars purchased and spent 28 per cent of the money spent for cars.

In purchasing automobiles and other selected durable goods, about 55 per cent of the prospective buyers in 1947 plan to pay full cash (including trade-in allowances). As shown in Table 3, this corresponds closely to the number of purchasers who expected to pay cash in 1946. Actually in that year a larger proportion of buyers, nearly two-thirds of the total, paid cash, and only one-third used installment credit. Cash payments, as shown in this table, include amounts obtained from current income during the year, withdrawals from previously accumulated liquid asset holdings, proceeds from sales of other assets and trade-in allowances.

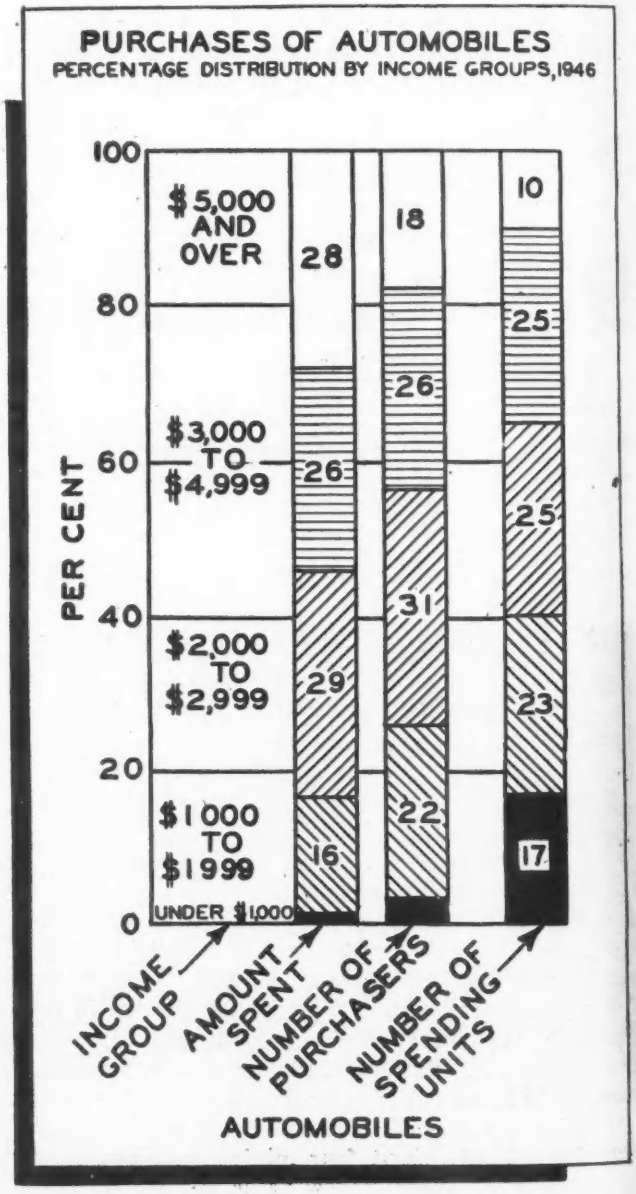
In financing their purchases of automobiles and other durable goods in 1946, consumers drew on their liquid assets somewhat more heavily than they had planned. Approximately one-third of the amount spent for these purchases during

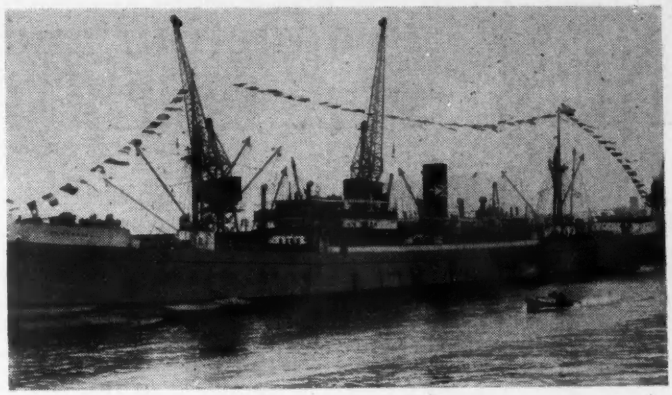
(*Turn to page 72, please*)

Table 5—Distribution of Purchasers of New Automobiles and Other Durable Goods, by Price Class, 1946 and 1947

[Per Cent]

Price class	1946		1947
	Prospective purchasers	Actual purchasers	Prospective purchasers
New automobiles:			
Under $1,000	5	3	2
$1,000–$1,349	62	27	33
$1,350–$1,999	22	52	43
$2,000 or over	2	16	12
Uncertain	9	2	10
All cases	100	100	100





S. S. St. Merriel, a 10,000 ton cargo ship ready to leave London for tour of principal South American ports to exhibit British products.

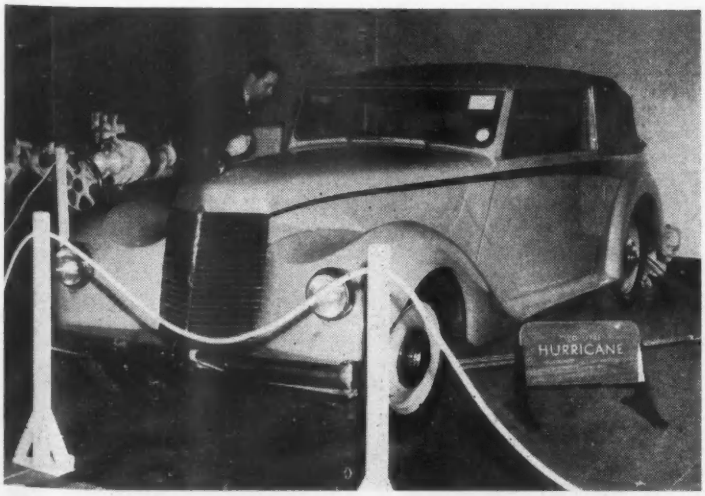
Britain's Floating Trade Show

Tours South American Ports

WITH a wide range of British products on display in one of its holds, the South American Saint Line's cargo liner S. S. St. Merriel recently made a tour of South American ports, the exhibition being the first floating one to be sent out by Great Britain since the end of the war. Thousands of merchants and other visitors are reported to have attended the trade show, resulting in a large number of orders being placed.

Although taking second place to the normal functioning of the ship, which was carrying cargo for scheduled Latin-American ports, the exhibition occupied some 45,000 cu ft of cargo space. The bulkheads were painted aluminum and off-white to reflect the maximum of light and special lighting, including fluorescent panels and large "floods," was installed. Air conditioning was provided for the comfort of visitors viewing the exhibition during the ship's stay in tropical ports.

The exhibition was organized by R. M. S. Morrison, Latin-American trade adviser to a number of British industrial concerns, in conjunction with the directors of the South American Saint Line, Ltd. It comprised over 50 industrial exhibits by 32 different companies. Representing a fair cross-section of British industrial achievement, an important feature of all the products shown was that they are available for immediate delivery or for delivery within six months of being ordered.



One of the 50 exhibits—a Hurricane cabriolet built by Armstrong Siddeley Motors Ltd. (British Combine Photos.)

Products exhibited ranged from all kinds of engines, machines, tools, pumps, and injection nozzles to electric cookers and baking mixing equipment. Representative of the engine field were replacement parts for Deutz Diesel engines by British Deutz Co., Ltd., Petter and Cub gasoline and Diesel engines by British Oil Engines (Export) Ltd. A Diesel-engined pile driver was shown by Lagonda, Ltd. Special interest was shown in the Hurricane 16 hp cabriolet by Armstrong Siddeley Motors, Ltd., the Bradford six seater utility by Jowett, Ltd., and the Pony industrial truck by the Brush Electrical Engineering Co., Ltd.

The ports at which the exhibition was opened to visitors were Rio De Janeiro, Santos, Montevideo, Rosario and Buenos Aires. While in port the ship was decorated and floodlighted. In addition to inspecting the exhibits, visitors were able to see a selection of industrial films in a small cinema specially erected

(*Turn to page 88, please*)

NEW Production and Plant EQUIPMENT

For additional information regarding any of these items, please use coupon on page 56

E-40—Vibration Type Loading Device

A new loader, developed by the Landis Tool Co., Waynesboro, Pa., for its centerless and centerless thread grinder, uses vibration for aligning screw blanks or similar parts and introducing them into the machine.

There are no mechanically moving parts, other than those for set-up adjustment. Hence wear, due to friction, is confined solely to the contact surface between the blanks and the hopper.

The action of the blanks in the hopper is unique in that they move up a circular, inclined ramp on the inside face of the hopper wall, until they enter the feed tube at the top of the hopper.

Landis vibrating type loading device

The purpose in elevating the screws in this manner is two-fold. First, since the ramp extends around the inside of the hopper for one and one-half turns, the relatively long path of travel aids in aligning the blanks before they enter the feed tube. Blanks lying crosswise on the ramp are forced off by vibration and over-balance, while the ones standing up are pushed off by a projecting deflector. Secondly, the blanks which are not aligned can fall back into the hopper without slowing up or interfering with the smooth flow of the blanks toward the feed tube.

The clockwise movement of the blanks in the hopper is obtained through direction vibration, by utilizing one-half of the sine wave of alternating current through rectification. Since the feed tube is essentially horizontal, the blanks are fed through this rectilinear vibration, stemming from the primary source.

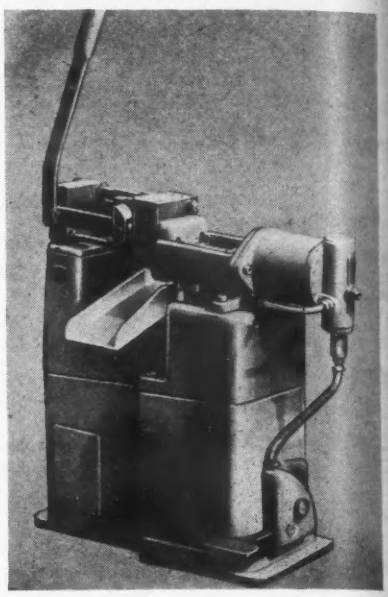
The rheostat knob on the front panel provides a convenient means for adjusting the rate of feed from a creep to full speed.

The loader readily handles blanks which are equal in length and diameter. A small agitating platform or pan, with a hole in one corner, receives the blanks from the ramp. Because of the manner of securing this pan to the hopper, enough extra vibration is induced to cause the blanks to dance or bounce across the hole in the floor of the pan.

This hole is a trifle larger than the diameter of the blank, but not large enough to permit the blank to pass through crosswise. If the blank hits the hole crosswise, it quickly bounces to an upright position and enters the hole. The feed tube, in this case, curves up under the hole and as soon as the blank goes through the hole in the pan, it enters the tube. One side of the pan is open to the hopper, so jamming cannot occur.

Four hoppers, each handling three sizes of blanks, cover a range of sizes up to ⅝ in. diameter. Removal of only two screws facilitates changing of hoppers, and loosening two screws permits changing the feed tube.

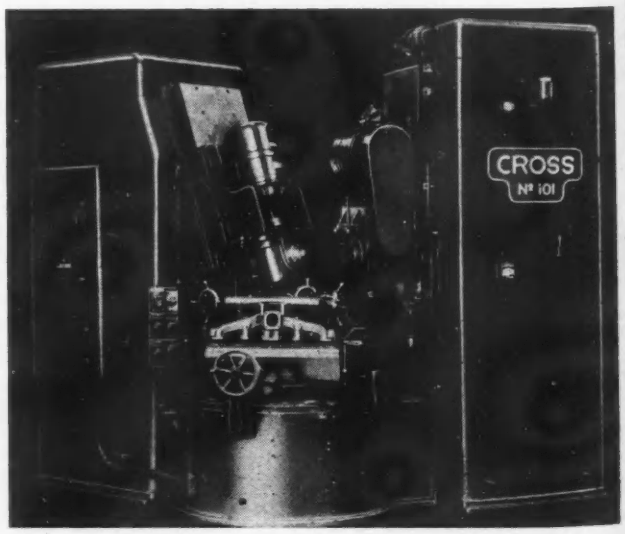
E-41—Small Die Casting Machine



This new three-oz cold chamber pressure die casting machine for aluminum alloys is offered by the DCMT Sales Corp., 315 Broadway, New York 7, N. Y. Simple, compact, and fast in operation, the ADC-56 utilizes inexpensive single cavity molds. Shown without accompanying preheat furnace for pre-melting the aluminum, it injects metal under high pressure with a pneumatically operated metal injection plunger

E-42—Special Machine Tool

A special machine tool, for milling the tail pipe flange and intake manifold joint face on exhaust manifolds, has been designed and built by The Cross Co. of Detroit, Mich. The operation is unusual because it takes place in confined quarters and requires an angular vertical feed for the first cutting station and a box-type feed motion for the



Cross special machine for milling exhaust manifolds

It's *Men Like This* who Make Inland Steel

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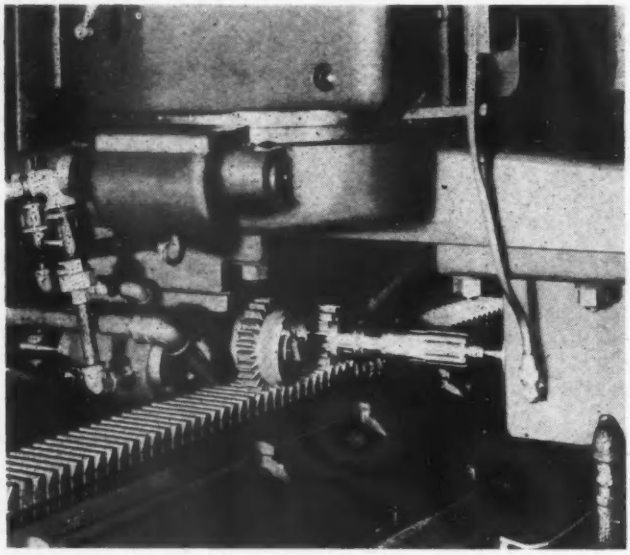


Gear finisher made by Michigan Tool Co.

second one. Production is 110 pieces, net per hour.

The machine is of the three-station, power-indexing type. The first station is used for loading and unloading the work, the second for milling the tail pipe connection, and the third for milling the intake manifold joint face. Work at all three stations goes on simultaneously so that one manifold is completed with each index. Carbide cutters are used to permit maximum feeds and speeds. Hardened and ground steel ways are utilized throughout the machine. All control, except work clamping, is by push button.

The machine is designed to take advantage of Cross standard elements. The second station utilizes a Cross No. 101 vertical column, modified for the angular feed; the third station makes use of the same type column without modifications. The 36-in. power driven index table is also a standard Cross unit.

F-43—Rack Type Gear Finisher

An improved rack type gear finisher —permitting the simultaneous finishing of two or more gears in tandem—manufactured by Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich., is designed to nearly double the productive output per hour of this type of gear finisher.

Hydraulic in operation, the machine has a duplex head and tailstock, permitting one gear to be mounted between centers and another on a stub arbor immediately ahead of the centers. The hydraulic clamping provided for the centers is interlocked with the machine operation so that the machine cannot be started until the gears have been mounted. Quick-lock type mechanical centers are also available on the new duplex.

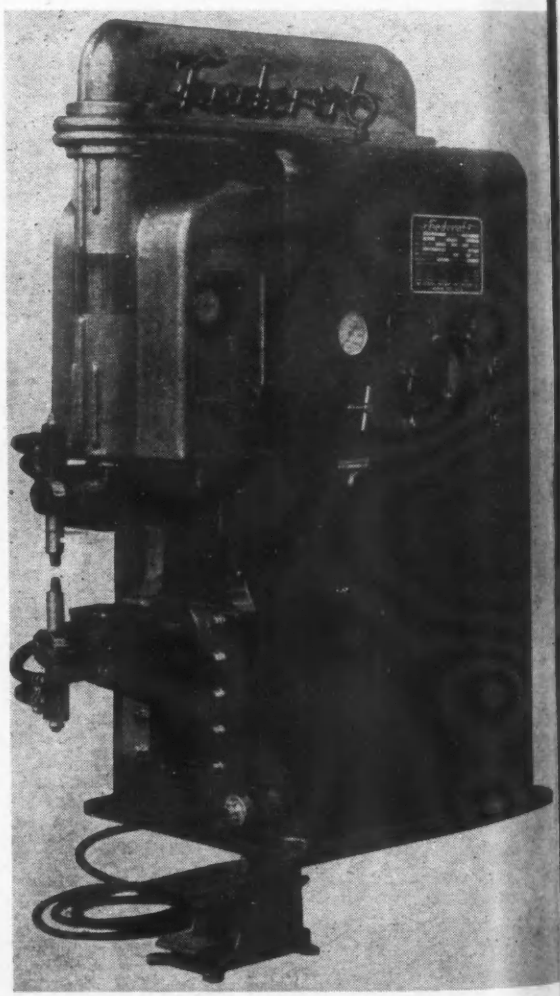
To shave two or more gears at a time, the gears, of course, must be of the same pitch and pressure angle. They may, however, be of different diameters and face width.

The new duplex type rack finisher will handle most passenger car or truck transmission gears. The gears are mounted at a "crossed axis" to the axis of the serrated rack blades and are given a transverse motion while rolling in mesh with the reciprocating rack. Rack blades, of course, have the same pitch and pressure angle as the gears to be finished.

During the shaving operation the machine head gradually feeds down until proper size has been reached, the machine reciprocates a few more times, and then stops for re-loading. Cycling is completely automatic.

(*Turn to page* 68, *please*)

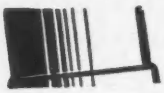
E-44—Improved Bench-Type Welder



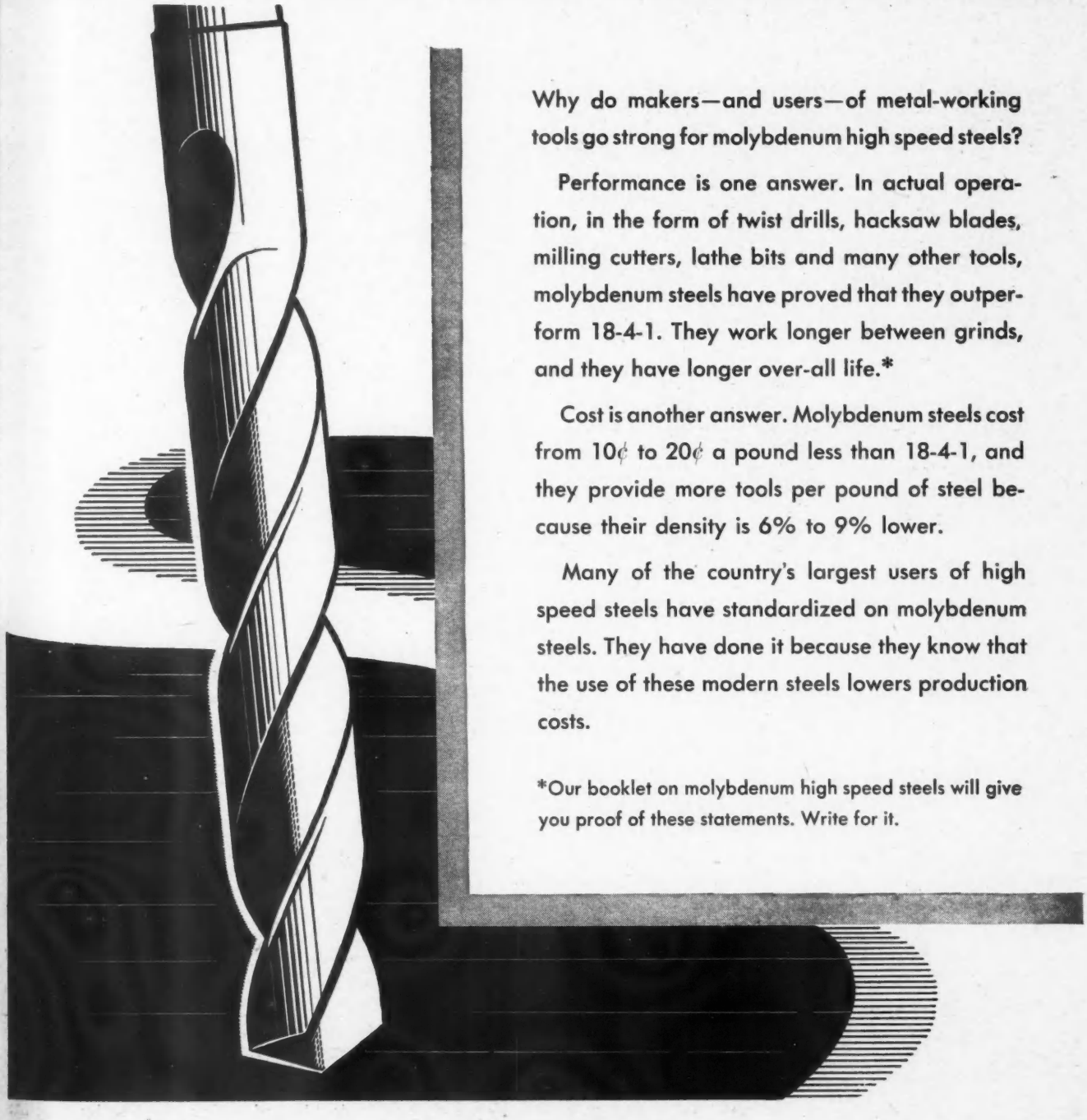
This general-purpose, air-operated bench-type combination spot and projection welder, made by the Federal Machine and Welder Co., Warren, Ohio, incorporates several improvements over former designs.

The machine is equipped with a special Federal low-inertia rubber head with microswitch firing. The vertically adjustable lower knee is standard as are the horns and water-cooled point holders. The 30 kva transformer, contained within the frame, has six steps of heat regulation which are controlled by the tap switch arrangement shown in the cut.

The 2¼-in. stroke of the machine is actuated by an air-operated, double-acting cylinder. Throat depth from the machine face to the center line of the electrodes is six in.; from the machine face to the center of platens, 4½ in.



WHY THE TREND IS TO Mo HIGH SPEED STEELS



Why do makers—and users—of metal-working tools go strong for molybdenum high speed steels?

Performance is one answer. In actual operation, in the form of twist drills, hacksaw blades, milling cutters, lathe bits and many other tools, molybdenum steels have proved that they outperform 18-4-1. They work longer between grinds, and they have longer over-all life.*

Cost is another answer. Molybdenum steels cost from 10¢ to 20¢ a pound less than 18-4-1, and they provide more tools per pound of steel because their density is 6% to 9% lower.

Many of the country's largest users of high speed steels have standardized on molybdenum steels. They have done it because they know that the use of these modern steels lowers production costs.

*Our booklet on molybdenum high speed steels will give you proof of these statements. Write for it.

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MOLY

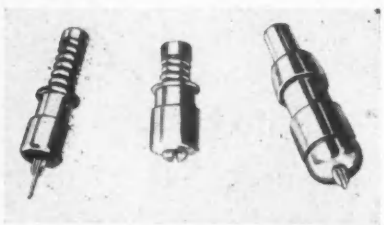
NEW Products for AIRCRAFT

For additional information regarding any of these items, please use coupon on page 56

F-32—New Type Skin Fasteners

New type skin fasteners are being introduced by Aircraft Tools, Inc., Los Angeles, Calif. Spring actuated, these Aircraft Tools skin fasteners are designed to temporarily hold metal sheets together, with 50 lb pressure, and in position preparatory to permanent assembly. They can be applied or removed by one individual from either side of the work.

Applied with pliers, these fasteners are of value in every type of manufacturing process, including aircraft,



Skin fasteners made by Aircraft Tools, Inc.

ship-building, sheet metal, and welding. They are available in various sizes ranging from 3/32-in. hole size to ¼ in. for material thicknesses ranging from ¼ to 1 in. Fasteners for material thicknesses in excess of 1 in. can be obtained on special order.

Aircraft Tools' skin fasteners are available in four standard sizes. In the smaller sizes, the standard and hooded type skin fasteners, the spring is completely enclosed. Skin fasteners for special thicknesses and the large size, heavy duty type have open springs.

F-33—Tachometer and Engine Hour Recorder

The 'Tacholog', a new combination tachometer and engine-hour recorder, has just gone into production at the Square D Company's Kollsman Instrument Division at Elmhurst, N. Y.

Eliminating the need for keeping an engine log, the 'Tacholog' provides cumulative indication of engine hours based on the average cruising speed of 2000 rpm.

This instrument is said to give unusually accurate indication of engine wear, as the engine hours are counted at a slower rate when the engine is idling and more rapidly when the engine is operated at a speed higher than the stated cruising speed. Since a simple conversion gives equivalent hours for various other cruising rpm, the unit is suitable for all types of aircraft.

The 'Tacholog' is made either with counter-clockwise or clockwise operating tachometer drives, and is lighter in weight than tachometers previously available. The elimination of a separate "engine time recording" instrument and the lighter weight of the new combination instrument should be of particular interest to owners of personal aircraft.

The Kollsman 'Tacholog' fits the AN Standard 3⅛ mounting hole and connection provided on the instrument is the standard SAE ⅞-18 T/I screw type. The instrument does not have any adverse affect on the compass even when the two are installed side by side.

F-34—Hydraulic Remote Control

A new miniature hydraulic remote control, manufactured by Sperry Products, Inc., Hoboken, N. J., has a torque capacity of 50 lb-in. on the pressure stroke and is rated as much as 50 percent more powerful than the earlier and slightly heavier Sperry model. Although the new Sperry product has numerous applications, its general uses cover throttle, mixture, governor, valve, and position indicator control.

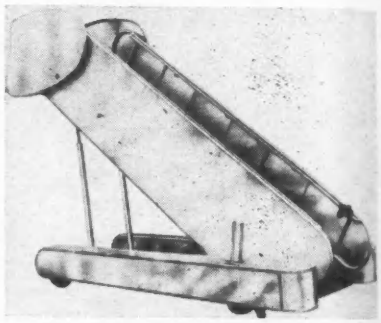
Like the larger Sperry controls, the miniature version consists of two units, a transmitter and a receiver, which form a self-contained, completely enclosed, hydraulic system when joined together by a single line of tubing and filled with oil. Only two small bolts are required to mount each unit in place. Copper tubing or flexible hose, which may be run through or around obstructions or bulkheads, makes it possible to install units in any location and to obtain remote control at distances up to 35 ft.

Transmitter of Sperry remote control

The Sperry Hydraulic Remote Control provides "feel" control of a distant mechanism since any motion of the transmitter arm will be duplicated instantaneously by the receiver arm. Either arm will move through an arc of 60 deg and the receiver arm may be drilled at any location to obtain the desired linear travel of the actuated rod.

F-35—Large Size Passenger Loader

Airquipment Co., Burbank, Calif., has announced the addition of a new passenger loader to its Aeroramp line. This



Aeroramp made by Airquipment Co.

new unit, like other Aeroramps, is hydraulically adjustable by manually operated pump. Its range is greater than other models, adjusting speedily from 80 in. minimum to 130 in. maximum platform height. The self-leveling steps, stairway angle, in relation to ground line is never greater than 39 deg. All exterior surfaces are covered with polished aluminum panels. Faired-in handrails and stair lights are provided, as well as external towing bar for ease of rolling the ramp to the aircraft. Retractable ground locks are provided for stability and rotatable upper platform side panels permit door opening after ramp is positioned and loading of galley supplies by fork lift truck into the cabin.

F-36—Approved Self-Locking Nut

The Boots Aircraft Nut Corp. of Stamford, Conn., has been accorded Army-Navy Aircraft approval on the "Hexlok," self-locking nut.

Of steel construction, this hexagon nut follows the Boots principle of "all-metal and one-piece." They combine the corrosion resistant qualities of "all-

(*Turn to page 68, please*)

3 BLADED PROP

Permatex Aviation Form-A-Gasket has 3 PROPerties of equal importance!

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When Aviation Form-A-Gasket is freshly applied, close fitting connections are easy to tighten up... all the way!

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Aviation Form-A-Gasket prevents corrosion and "freezing" of all metal parts used in modern engine assemblies ... because an applied film seals out all air and moisture!

Will not run at 400° above ... nor become brittle at 70° below!

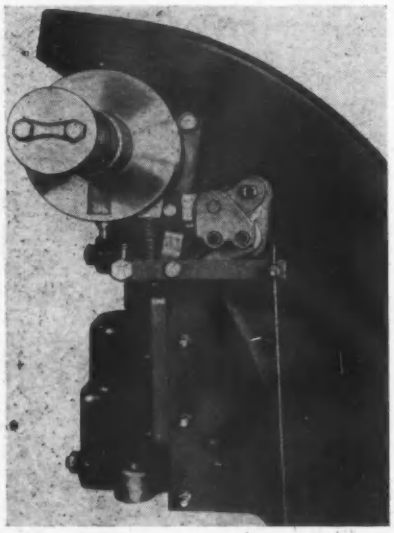
PERMATEX COMPANY, INC., BROOKLYN 29, N. Y.

NEW Products

For additional information regarding any of these items, please use coupon on page 56

F-37—Presses with Non-Repeat Clutch

The Federal Press Co., of Elkhart, Ind., has brought out a new non-repeat clutch mechanism on its entire line of open back inclinable presses. This exclusive feature insures single-stroke operation regardless of how quickly the foot pedal is depressed, or how long the operator holds the pedal in depressed



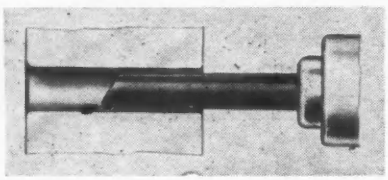
Federal non-repeat clutch

position. It is easy to trip, and provides positive stroke control.

With the new clutch mechanism, the operator need not move from working position or use any tools to adjust the machine from single to automatic cycle, or reverse. His only action is to give the positive control bolt a one-quarter turn. The non-repeat clutch provides one complete cycle and stop before the press can be retripped in single cycle action. Downstroke repeats and accidents caused by the crank passing its cycle center are definitely prevented. The new safety feature is immediately available on all Federal presses from 6 to 80 tons.

F-38—Boring Bars Of Solid Carboloy

Boring bars made of solid Carboloy cemented carbide—making possible the precision boring of holes having a length to diameter ratio as high as eight to one—are now available from Carboloy Co., Inc., Detroit, Mich. Eight sizes in two styles are now standard design items.



Boring bar of solid carboloy cemented carbide

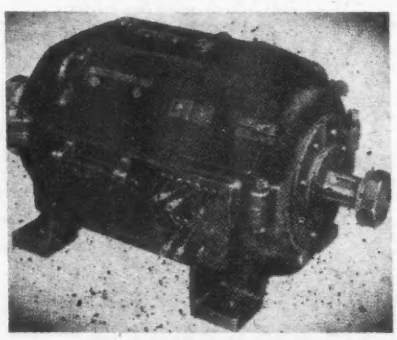
The high degree of rigidity possessed by these solid carbide bars—2.8 times greater than that of steel—makes possible the precision boring of holes having a relative length of up to eight times hole diameter. Formerly, four times hole diameter was about the practical limit. The greater stiffness inherent in carbide metal keeps these longer boring tools from backing away from the work and also from "winding up" in the hole.

The boring of automotive and aircraft valve guides, piston wrist pin holes, etc., are among the applications of solid Carboloy boring bars. These new boring bars are suitable for precision boring of steels; cast iron (including the fine grain cast irons); bronzes; brasses, and aluminum alloys.

The two types of carbide boring bars are (1) a solid carbide bar with a carbide boring tool brazed into a recess in one end of the bar; and (2), a solid carbide bar carrying a steel insert at one end of the bar in which the carbide boring tool is held and adjusted with set screws.

F-39—New Line of Mill Motors

A new line of mill motors reduced one frame size is offered by Westinghouse Electric Corp., Buffalo 5, N. Y. A larger and more efficient armature that fits within the limiting dimensions of the



Westinghouse 100-hp, frame 614, mill motor

motor frame, new roller bearings and bearing housing, and redesigned field coils make the new motor possible.

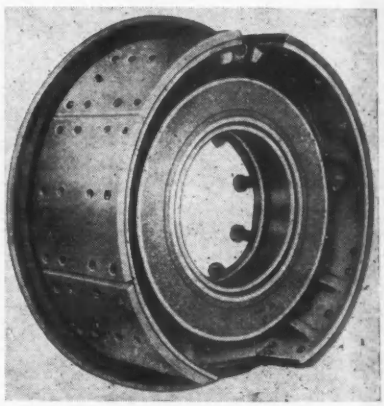
The heavy duty type MC mill motor is available in totally enclosed, protected self-ventilated or protected force-ventilated construction. It is built in accordance with the AISE standardized dimensions and incorporates the following features: Split frame of cast steel; silicone insulated armature coil conductors; wedges of Class B material to hold coils in slots; new roller bearing and bearing housing that eliminates need of thrust washer and collars; improved field coil insulation; and rigid mounting of brush holders.

It is available in szes from 5 to 200 hp; in voltages of 230 and 550; and in AISE dimension frames 602 to 618.

F-40—Latest Electric Brake

A recent development of Warner Electric Brake Mfg. Co., Beloit, Wis., is a new self-adjusting electric brake with two-shoe, hinge-type construction. This new brake is available in sizes 16½ by 5 in. and 16½ by 7 in.

As with all Warner Electric brakes, this is a simple mechanical brake, op-



Warner Electric two-shoe brake

erated by an electro-magnet and armature disk which presses lightly against the magnet. The armature revolves with the wheel while the magnet remains stationary.

Positive-acting braking power is developed within the brake itself. There is no time lag, as the braking mechanism is electrically controlled. Regardless of the distance from cab to rear trailer wheels, any amount of stopping power is instantly available.

The new Warner Electric brakes are said to be inexpensive to install. They use about as much current as a tail light.

The controller is operated from the driver's seat and permits the driver to apply any degree of braking power. As the controller lever is moved electric current flows through the electro-magnet. The current energizes the magnet and causes it to cling to the revolving

(Turn to page 60, please)

NEW GASKET GUIDE

Booklet offers condensed data on materials and applications

Just published, "Armstrong's Gasket and Sealing Materials" puts into 20 pages the essential data you need to make a tentative choice of the proper resilient gasket or sealing material.

The first half of this booklet is devoted to application data and charts. These give the physical characteristics of each of Armstrong's four major types of materials: synthetic rubber compounds, cork-and-synthetic-rubber compositions, cork compositions, and fiber sheet packings.

The second half of this new booklet offers practical help on the selection and use of resilient sealing materials. Discussed here are such topics as: proper flange design, designing gaskets to reduce cost, and correct compression for various materials.

Write today for a copy of "Armstrong's Gasket and Sealing Materials." Armstrong Cork Company, Gaskets and Packings Dept., 1508 Arch Street, Lancaster, Pennsylvania.

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PUBLICATIONS AVAILABLE

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D-39—Full Automatic Lathes

Pratt & Whitney Div., Niles-Bement-Pond Co.—Circular No. 492 describes and illustrates the Model C Full-Automatic Lathe and includes a description and illustration of the Full-Automatic Centering Machine. Contents include construction and operating details, typical job applications, equipment supplied and specifications of the Model C.

D-40—The "Products Of Eaton"

Eaton Mfg. Co.—In addition to axles, valves, springs, etc., the new 1947 edition of the booklet Products of Eaton, includes by illustration and description a number of new Eaton developments, namely, dynamometers, vehicle fan drives, etc.

D-41—Bronze Bearings

Bunting Brass & Bronze Co.—A new catalog on standard bronze bearings, bronze bars and bronze electric motor bearings. It includes complete listings of new bar sizes, new standard stock sizes and new electric motor bearing sizes. It describes by text and drawings special bearings which Bunting manufactures to customers' blueprint specifications. Engineering information covers the installation of bearings, recommended table of press fits, instructions for grooving and for the selection of the proper type of groove, typical housing and lubrication designs for sleeve bearings and instructions for the grinding of tools to machine cast bearing bronze.

D-42—Recording Thermometers and Gages

The Bristol Co.—A new 16-page bulletin, No. T835, giving detailed information in description and picture form of the new instruments. Complete information covering chart ranges, chart drives, thermometer bulbs and measuring elements is also included.

D-43—Die-Casting Machines

Hydropress, Inc.—A new circular covering the Hydrocast cold chamber die casting machine. The advantages of the machine are given, basic principles are described and illustrated by means of line drawings. Complete specifications are given for the various model numbers.

D-44—Safety Tools

Ampco Metal, Inc.—Safety Tool Catalog No. 118 shows many hand tools available for use in hazardous locations. Tools are recommended for use in the presence of explosive liquids, fumes, gases or dust as a safety measure.

D-45—Automatic Plating Conveyors

Hanson-Van Winkle-Munning Co.—A revised edition of Bulletin FA-103 covers the full line of plating conveyors, including the elevator type, Munning type, straight line type, special plating machines, caustic cleaning lines, tin plating lines, wire and cable plating and zipper plating.

D-46—Index to ASTM Standards

American Society for Testing Materials—An index to ASTM Standards which enables any of the approximately 1400 standard specifications and tests in the volumes to be located readily. Items are listed in the index under appropriate key-words according to the particular subjects they cover. To secure a copy, please write to American Society for Testing Materials, 1616 Race Street, Phila. 3, Pa.

D-47—Bearing Alloys

American Smelting and Refining Co., Federated Metals Div.—A technical manual on bearing alloys gives information on the design, construction and maintenance of friction-type bearings for all kinds of machinery. A history of bearing metals is included together with tables of SAE and ASTM specifications. Other booklets cover the following topics; bearing alloys brands;

(*Turn to page* 70, *please*)

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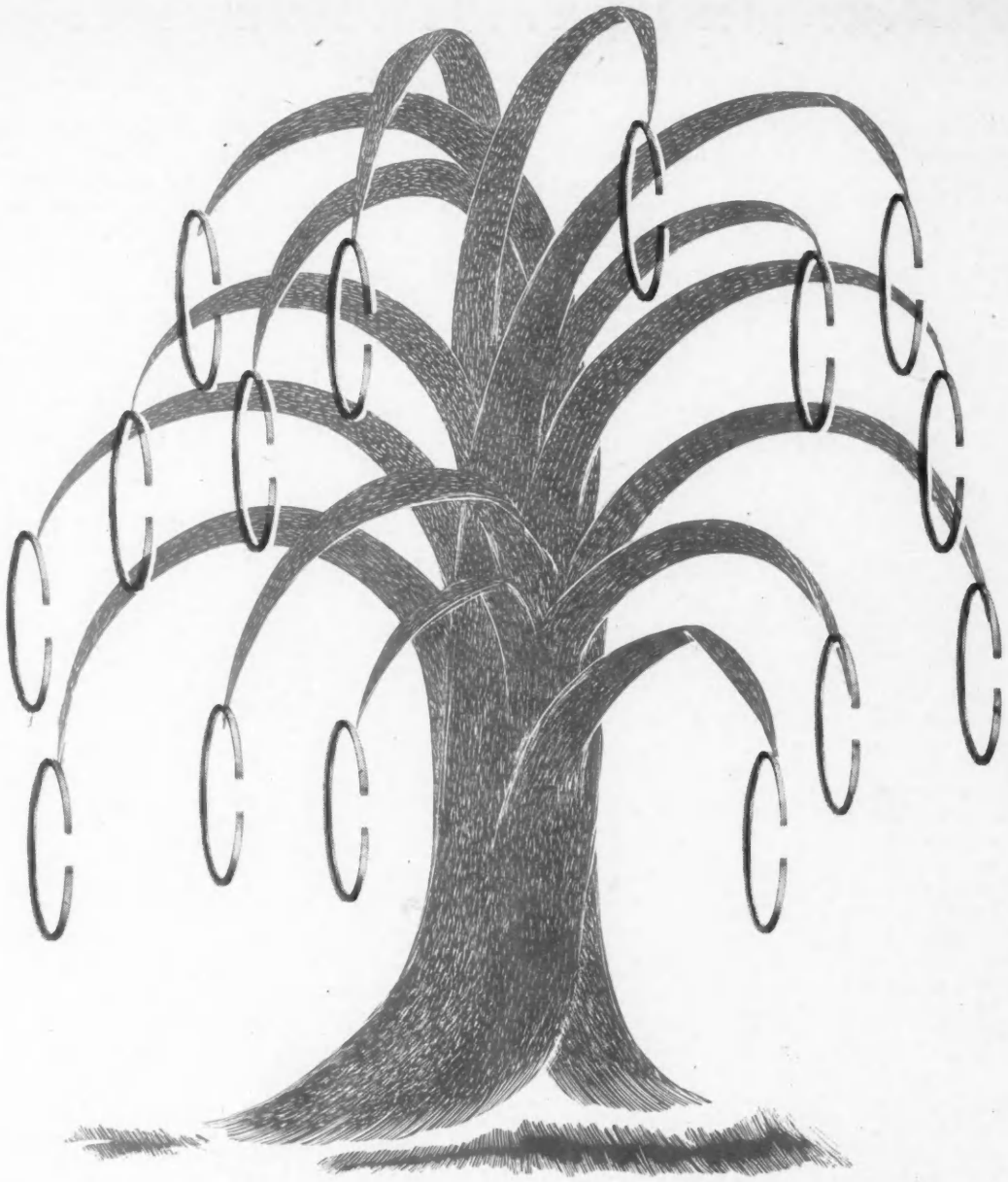

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Sealed Power began business in 1911. Major engine builders soon discovered the superiority of Sealed Power products. As the demand for Sealed Power motor parts has grown, our plant, our laboratory facilities and our technical staff have grown. Today these are the finest in Sealed Power history. You are invited to use the full resources of Sealed Power to help make your good engines even better.

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Helicopter Power Plant Installations

(*Continued from page* 40)

idling phases and there is no propeller to act as a flywheel as in the airplane. A well designed helicopter cooling fan will weigh from 0.05 to 0.08 lb per engine bhp, these figures being especially useful in preliminary design.

Another consideration centered around the cooling fan is the power which it absorbs, power which otherwise could be converted into useful load. Since engine cooling absorbs from three to five per cent of the bhp, at current power loadings of 10-12 lb per bhp, this represents a diversion of a very substantial proportion of potential lifting capacity.

Exhaust Ejector

A full realization of the power cost of cooling with a fan leads to the exhaust ejector. The ejector can be made to cool completely the more modern good cooling engines which require low mass flow and pressure drops, whereas some of the older engines are more difficult to cool and the ejector becomes marginal. In the latter case, the ejector can be supplemented with a fan to provide full cooling, the fan being designed to provide the energy difference between the total required and that available from the ejector. Satisfactory ejectors can be built at a weight of from 0.075 to 0.090 lb per bhp, falling roughly in the same weight category as a cooling fan. It is not difficult to visualize the potential gains in useful load by proper use of the ejector.

One of the problems which presents itself when an ejector is being considered as the only source of cooling air pumping is, what about the engine flywheel which was so conveniently supplied by the fan? One solution to this is illustrated by use of an ejector operating in conjunction with a fan as used on the Bell model 42 design. This is shown in Fig. 2, and represents a very satisfactory compromise in design.

Suspension Systems

At the present time there are two general suspension systems in use, the rigid pylon and the flexible or elastic pylon. The rigid pylon system is one in which the rotor mast is rigidly attached to the fuselage. The engine can be remotely located as in tandem rotor arrangements or may be closely coupled as in single rotor ships. The essential point is that the rotor, mast and engine are separately mounted, and elastic problems are independent of each other. In the rigid pylon the gear reduction box is usually located as close to the rotor as possible and is driven through a torque shaft and universal joint. Fig. 3 shows a typical installation using a rigid pylon. The engine can be mounted from its normal mounting points and can be either elastically or rigidly attached to the fuselage. In this illustration it is mounted rigidly from the normal rearward points as designed for airplane installations. This system is generally in use with fully articulated and rigid rotor systems with rotors of odd number of blades. The odd blades balance out certain parts of the periodic forces which act on the mast during forward flight and a rigid connection to the fuselage can be tolerated.

The elastic pylon system wherein the rotor mast, gear box and engine are all connected together and suspended as a single mass is being currently applied on the Bell two-bladed "see-saw" rotor machines. The two-bladed rotor offers great advantages in simplicity of the rotor and hub and requires much less storage space than three bladed rotors. However, it needs a different engine suspension to take advantage of this simplicity effectively—hence, the flexible pylon which isolates the rotor suspension from the body through elastic supports. By this method the vibrations set up by the rotor are absorbed and dissipated by the large elastically suspended mass of the rotor, transmission and engine, thus isolating both engine and rotor vibration from the passenger compartment. Since there are no direct metal to metal contacts between the pylon and body, the harsh high-frequency buzzing type of noisy vibration is also eliminated from the body. A typical system of this type as applied to the Bell five-place helicopter is illustrated in Fig. 2. The engine itself is not mounted from its normal mounting points to the rear, or bottom in this case, but is attached to the transmission through the nose case of the engine. This figure also shows many of the other main power plant features such as fan, cooling air inlets, ejector outlet, exhaust system, fuel tank locations. The general problem of submerging the engine within the body is also illustrated.

Another feature, common to most single rotor machines is also indicated here—the vertically mounted engine. Although this is not a "must" to the helicopter designer, it has the advantage of short, direct drive to the rotor with its inherent simplicity and lower weight. The problems it presents to the engine designer are primarily those involving lubrication and accessories as it does not appear to alter seriously the basic engine operating characteristics. Accessory drives such as magneto, starter and generator should be designed with seals so that oil cannot seep into them and cause malfunctioning. This has been a common fault with airplane engines adapted to vertical mounting primarily because seals were not a requisite on aircraft engines horizontally mounted. Minor changes in the engine lubrication systems are also required so that all bearings and critical points on the top side of the engine are properly oiled.

Helicopter power plants do not require engines whose main crankshaft bearings have been designed to carry large thrust and gyroscopic propeller loads as those utilized in conventional airplane type engine installations. Thrust loads of a minor nature will only be encountered when a cooling fan is attached to the crankshaft.

Center of Gravity Location

Another of the major differences between power plant installations in the helicopter and fixed wing design aircraft is concerned with the center of gravity location. In fixed wing design the power plant is utilized to balance the craft about the mean aerodynamic chord. In single rotor helicopters using the two previously mentioned methods of suspension for the pylon, the use of the power plant to balance the craft is extremely limited. This is due to the fact that the disposable fuel load must be held close to the center of gravity. It is also desirable to locate the engine close to the mast. This crowding for space generally necessitates the division of the fuel capacity as nearly as possible into two equal quantities which are located close to the engine. The center of engine mass is on the center of gravity of the craft or extremely close to it. Only a few of the fuel and oil system accessories can be moved around to aid in placing the overall center of gravity where desired. In actuality the only power plant component that seems to adapt itself more to humoring this condition is the oil system. For this reason the oil system is affected more frequently in the course of design than the other components of power plant.

Accessibility

The helicopter engine is surrounded by structural elements such as firewalls, fuel tanks and cooling ducts so that it becomes a major and very difficult problem of design for serviceability. Firewalls which are fume-proof and fireproof must be inserted between the engine compartment and the passenger compartment, and must also enclose separate fuel tanks from the general engine exhaust areas. Since the rotor loads are applied near the top of the body and the landing gear loads near the bottom, there must be continuity of structure between these points. The mutual arrangement of power plant and structures must be given unusual attention in the early stages of design so that engine accessibility may be maintained.

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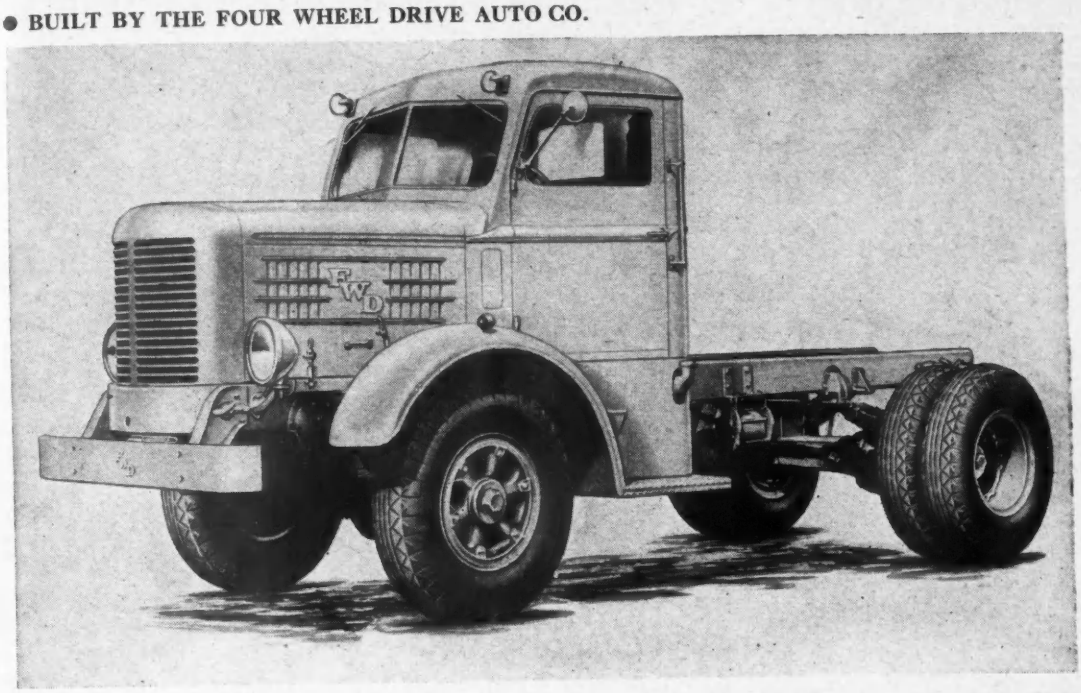

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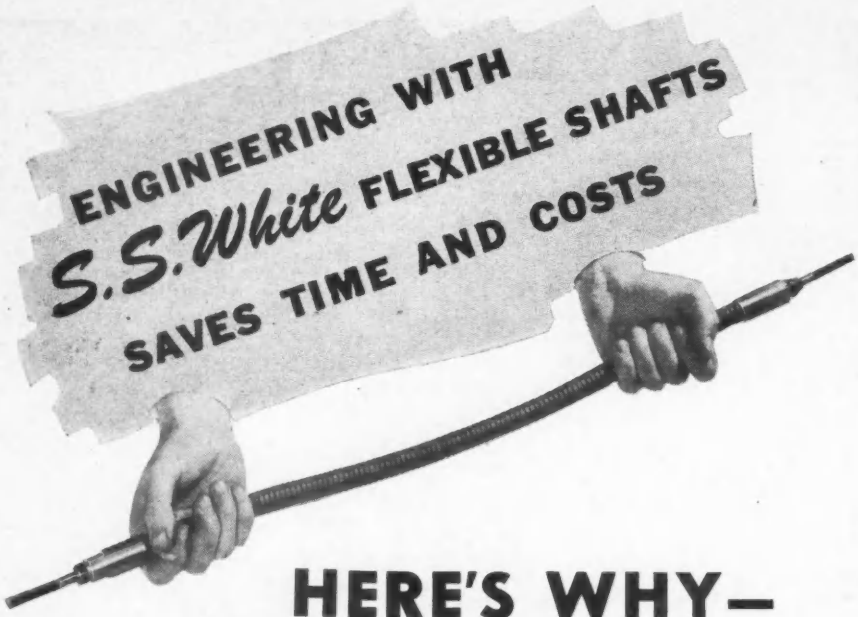

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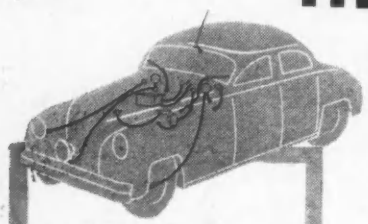

TYPICAL AUTOMOTIVE APPLICATIONS

POWER DRIVE

Movable Tops
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Taximeters
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Windshield Wipers
Truck Cranes
Air Conditioners

REMOTE CONTROL

Choke Valves
Clock Reset
Trip Odometers
Drain Valves
Engine Governors
Radios
Radio Antennas
Spotlights
Heaters

One of the problems in engineering motor vehicle designs is the location of accessories. Accessories that require remote control complicate the problem. The same is true for accessories that require rotary power drive.

Fortunately, S.S.White flexible shafts provide a really simple solution to this problem—a solution that saves time and money because of their extreme simplicity and ease of application. With one of these shafts you can transmit power or provide remote control between any two points in a motor vehicle. This gives you complete freedom in placing both accessories and controls anywhere you want them.

WRITE FOR THIS 260-PAGE FLEXIBLE SHAFT HANDBOOK

It gives complete facts and engineering data about flexible shafts and their application. A copy is yours if you write for it on your business letterhead and mention your position.

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431 VENICE BLVD., LOS ANGELES 15, CALIF.

NEW PRODUCTS

(*Continued from page* 54)

armature disk. The more current the driver allows to reach the magnet the tighter it clings to the armature. This causes the magnet to shift. Attached to the magnet is a lug. When the magnet shifts it presses the cam against the brake band end thus applying the brake.

The Warner controller synchronizes hydraulic, vacuum or air brakes on tractor with electric brakes on trailer. Regular tractor foot pedal then operates both systems *together*.

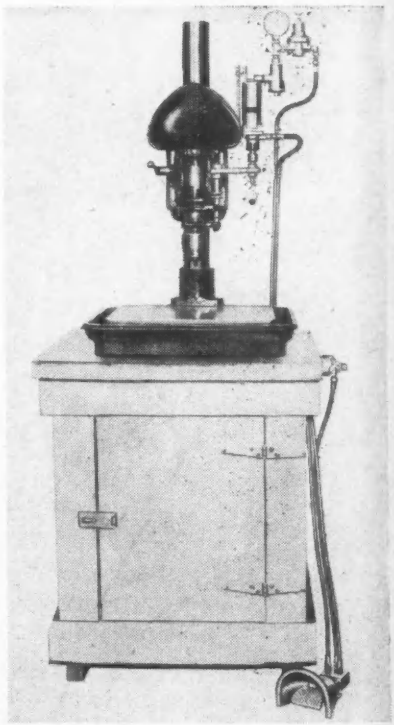
Grabbing is eliminated because there is always a slight slipping action between the magnet and armature.

F-41—Generator for Small Vehicles

A small electric light generator for motor bicycles, scooters and other small

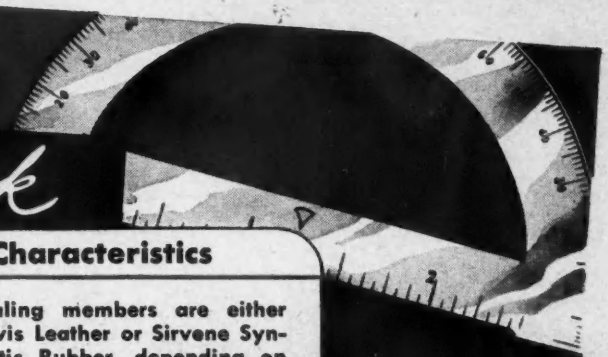
(*Turn to page* 64, *please*)

F-42—Drill Press Kit



Supplied in the form of a kit by the National Pneumatic Co., Rahway, N. J., this N.P. pneumatic operating equipment is "pre-engineered" for quick and easy installation on drill presses used for production drilling. The kit consists of an operating assembly — including air engine, pressure gage, pressure regulator, exhaust valve and cushioning plug —together with foot-operated control valve, air strainer, cut-out cock and flexible hose. The engine provides controlled air power which can be adjusted to suit any drill size or stock and to permit maximum drilling pressure and speed within safe limits.

A Page for the *Designer's Notebook*



On "Perfect" Oil Seals—Their Characteristics

1. Retain lubricant and exclude both moisture and foreign-matter to give bearings and operating mechanisms maximum protection.
2. Applicable to shafts, horizontal, vertical or placed at any angle, within or protruding from a mechanism.
3. Suitable for use with any standard lubricant.
4. Resistant to oils, greases, water, acids and alkalis.
5. All steel encased—self-contained and ready to press into place in bearing housing or elsewhere in the assembly.
6. Require just a minimum of design space.
7. Self adjusting in operation—no take-up, no maintenance, consequently, they can be used in inaccessible locations.
8. Sealing members are either Sirvis Leather or Sirvene Synthetic Rubber, depending on the type of service to be encountered.
9. Wiping lip is spring loaded to hug the shaft and prevent leakage without undue skin friction.
10. Sealing member is anchored and cannot rotate with the shaft.
11. Sealing member materials will not wick away lubricant from protected bearings.
12. All dimensions held to extremely close tolerances for accurate fitting.
13. Choice of 18 different models with size range from ¼" to 48" OD.
14. Twenty years of successful industrial service with performance records on which to base design for new applications.
15. Chicago Rawhide engineers available for consultation and to save your time.

69 Years Manufacturing Quality Mechanical Leather Goods Exclusively and Now Sirvene Synthetic Products

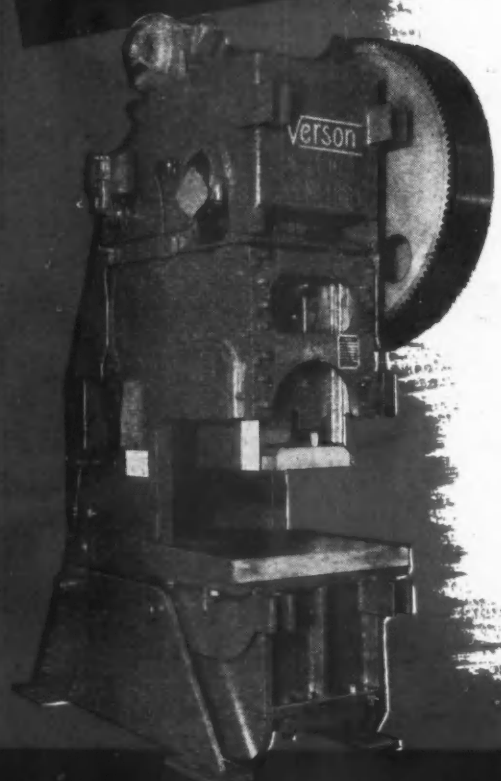
PHILADELPHIA • CLEVELAND • NEW YORK • DETROIT • BOSTON • PITTSBURGH • CINCINNATI

2667

a TRADE Verson MARK ...from 60 TONS UP!

- BLANKING
- DRAWING
- FORGING
- COINING
- IRONING
- BENDING

One of the "babies" of the Verson line is this No. 7½ Open Back Inclinable. Rated at 105 tons capacity it weighs 24,000 pounds and has an overall height of 139 inches.



Whatever your requirements, if they call for 60 tons or more, you'll find there is a Verson Press suited to your needs . . . single, double and triple action straight side mechanicals and hydraulics, gap frame mechanicals and hydraulics, open back inclinables, post-type hydraulics, press brakes and high production models including fully automatic transfer feed presses.

There are over 5000 Verson Presses in daily use all over the world taking part in the production of everything from ash trays to box cars. The allsteel welded frame, originated by Verson over 25 years ago, plus numerous other engineering advances makes it possible for these presses to do their job efficiently and dependably in the severest service.

VERSON ALLSTEEL PRESS COMPANY
9307 S. Kenwood Avenue, Chicago 19, Illinois

OPEN HOUSE AT VERSON
September 17 to 26

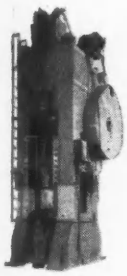
When you're in Chicago for the Machine Tool Builders' Show, be sure to include the Verson Plant in your itinerary. All press building facilities will be in operation and in addition, several Verson presses will be set up and operating for your inspection.

ORIGINATORS AND PIONEER BUILDERS OF A

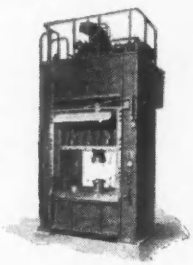
press for every job!

Open Back Inclinable

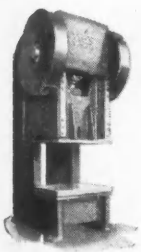
Straight Side Mechanical; Single, Double and Triple Action



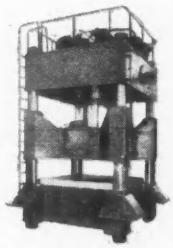
Knuckle Joint



Straight Side Hydraulic; Single, Double and Triple Action

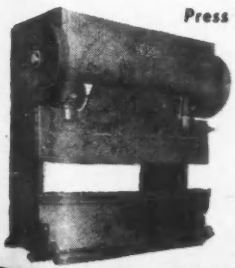


Gap Frame Mechanical and Hydraulic



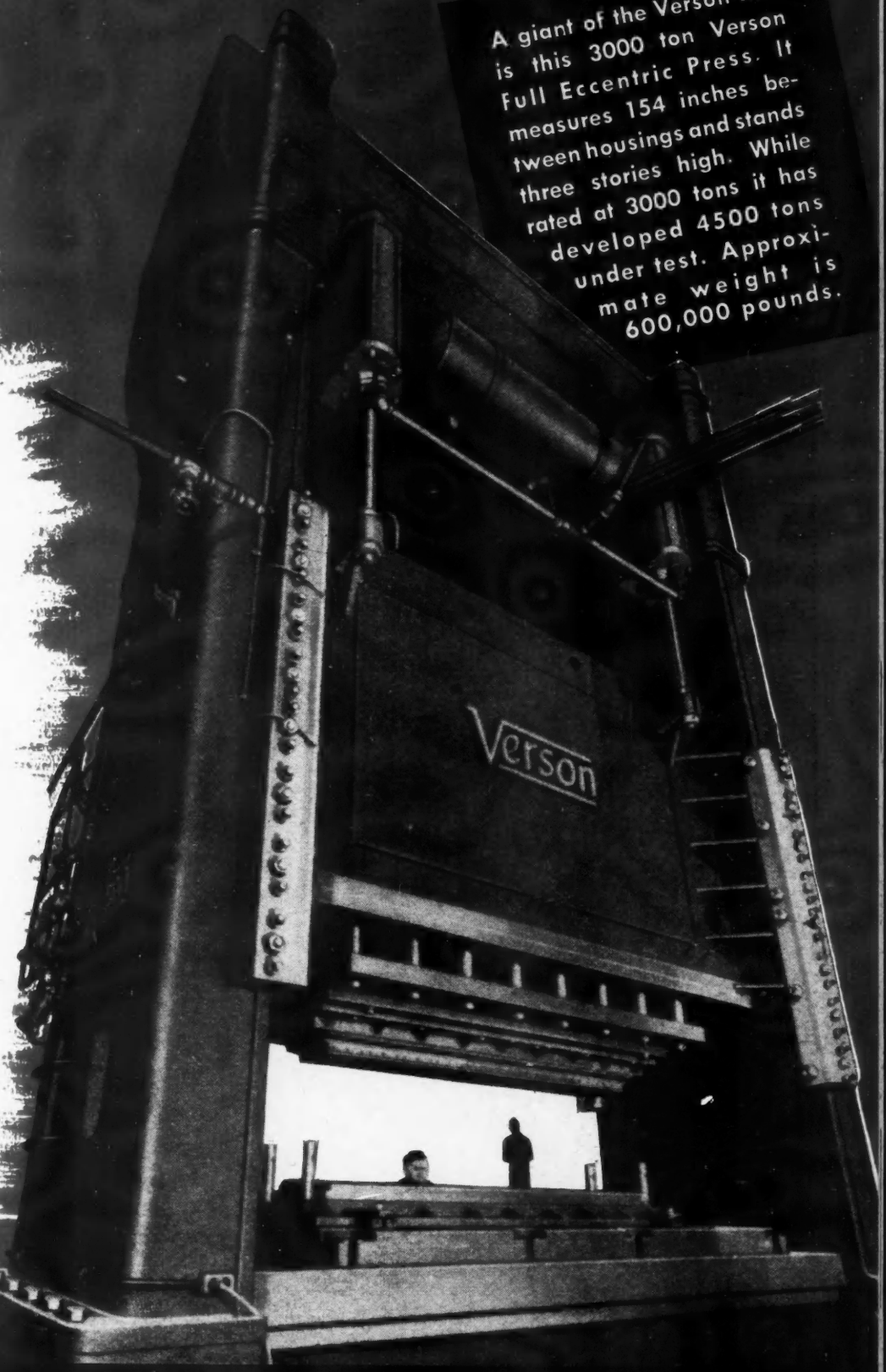
Post Type Hydraulic

High Production Presses



Press Brakes

A giant of the Verson line is this 3000 ton Verson Full Eccentric Press. It measures 154 inches between housings and stands three stories high. While rated at 3000 tons it has developed 4500 tons under test. Approximate weight is 600,000 pounds.



OF ALLSTEEL WELDED PRESS CONSTRUCTION

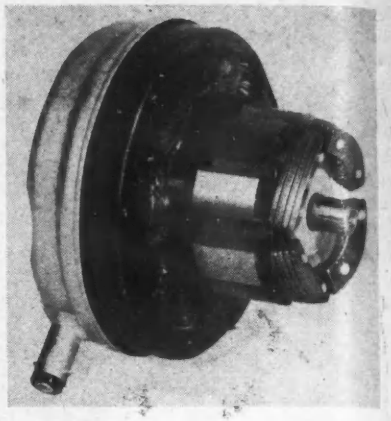
motorized vehicles has been developed and is currently manufactured by Bendix Products Division of the Bendix Aviation Corp. at South Bend, Ind.

The generator is disc-shaped and measures only 3½ in. in diameter by 1½ in. thick, and develops 35 watts at 6-8 volts. It is driven by a friction disc which rests against the engine flywheel or vehicle tire. Two integral assemblies are provided for a swivel mounting. A latch assembly is also provided where required.

The generator consists of a stationary ring of eight field coils, with one grounded and one insulated terminal. The rotating member is a powerful Alnico permanent magnet, which is disk-shaped and notched to provide pole pieces corresponding to the stationary coils.

Voltage regulation is accomplished by an original and ingenuous means. There are four segments attached to the rotor shaft each by a separate leaf of spring steel. At low speeds all four of these segments run clear of the rotor, allowing the full magnetic field to act upon the stationary coils. At predetermined speeds the "fly-ball" segments extend and touch the rotor so as to "short current" the magnetic field.

Since each segment is supported in a spring leaf of different strength, the segments come into effect progressively and one at a time. The result is a progressive weakening of the effective magnetic field as speed increases, thus regulating voltage within the allowable maximum. This automatic regulation provides for adequate lighting at engine idling speeds and does not exceed nominal rated lamp voltage at maximum speed.



Bendix generator with cover removed to show the rotor and regulating segments

There are no wearing parts such as commutator, slip-ring or contacts; the rotor bearings are self-lubricaetd Oilite.

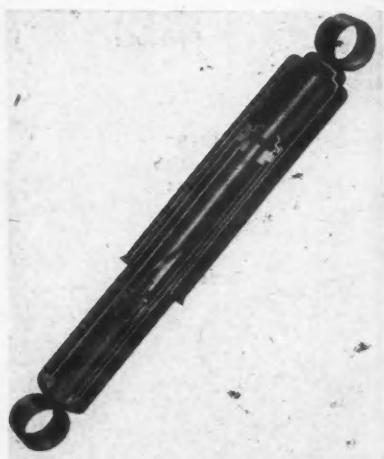
The generator is furnished together with a sealed-beam headlight of 30 watts rating, taillight and license bracket, and all necessary wiring and fittings but where preferred the generator may be used with a conventional 32 c-p headlamp.

At present the unit is available to engine, vehicle and implement manufacturers only, for original factory equipment on their products.

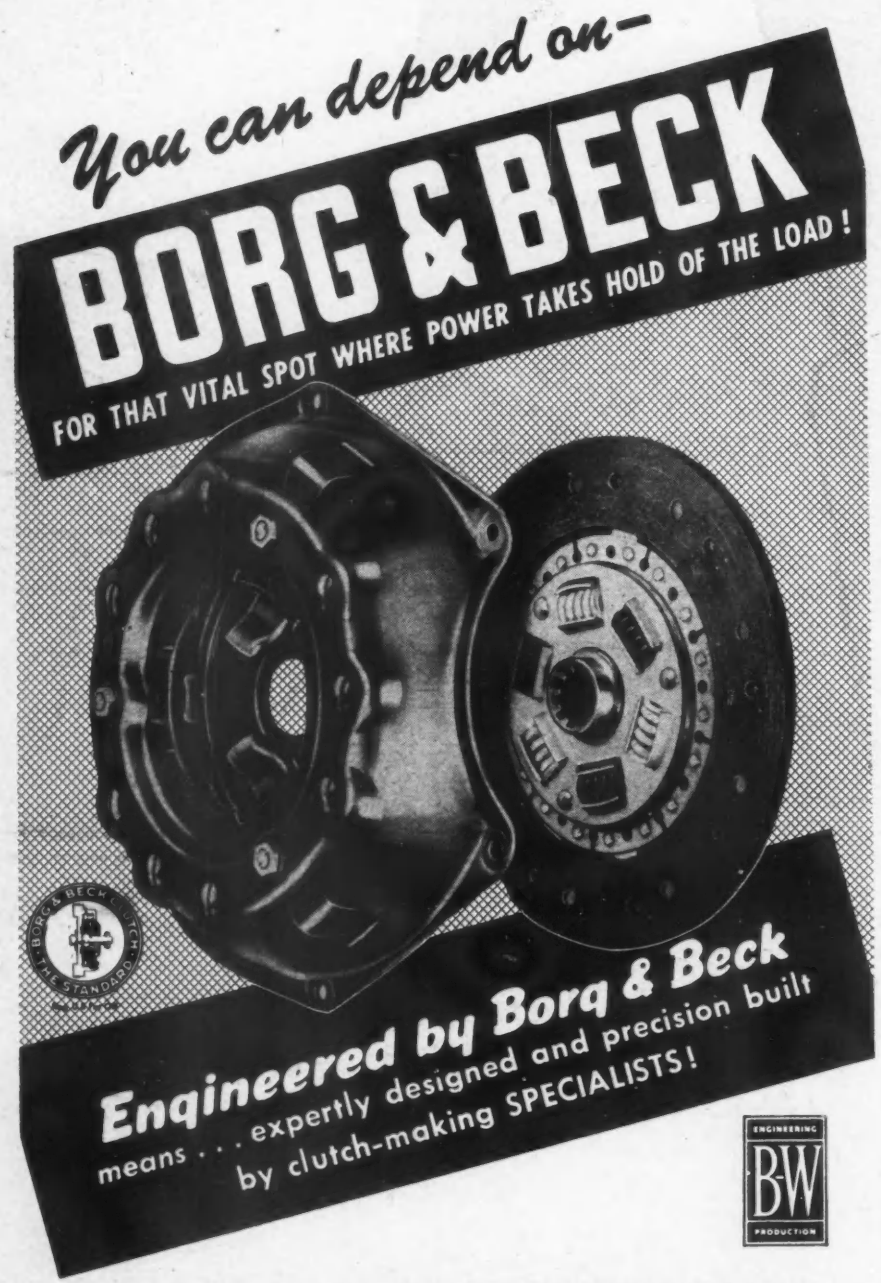
F-43—Direct Action Shock Absorbers

In addition to Houdaille rotary shock absorbers, the Houde Engineering Division of the Houdaille-Hershey Corp., Buffalo, N. Y., is now producing a line of direct-action types. The new direct

(*Turn to page 67, please*)



Houdaille shock absorber


You can depend on—
BORG & BECK
FOR THAT VITAL SPOT WHERE POWER TAKES HOLD OF THE LOAD!
Engineered by Borg & Beck
means . . . expertly designed and precision built
by clutch-making SPECIALISTS!
BORG & BECK THE STANDARD OF THE WORLD
ENGINEERING B-W PRODUCTION

BORG & BECK DIVISION
BORG-WARNER CORPORATION
CHICAGO 38, ILLINOIS

action models in no way presage the discontinuation of the rotary line. The new type, it is said, was developed both to give more complete coverage of the entire automotive field.

The shock absorbers are calibrated, filled and permanently sealed at the factory thus eliminating all adjustments and servicing. The working cylinder of each instrument is highly polished to extremely close tolerances while the highly polished, chrome plated piston rod operates through guides of long-wearing bearing metal. The over travel "pick-up" is said to be exceptionally husky to protect it against cracking or breakage. Both the combination orifice and coil spring overload rebound valve and the foot valve are non-aerating, and a baffle ring prevents the aeration of the fluid in the reserve reservoir.

An oversize replenishing valve is used to facilitate the flow of fluid from the reservoir into the cylinder.

The rod when extended is protected by a dust shield, while models for rear-suspension installation have an additional shield to protect them against damage from flying stones. Mountings of both ring and bayonette type are fully insulated against noise with rubber.

F-44—Aluminum Roofing Material

Production of a new, high-quality aluminum roofing material for industrial use, to be called Alcoa Industrial Roofing, was announced by Aluminum Co. of America.

The new product is a lightweight, heavy-duty specially-formed material, developed by Alcoa research to meet the demand of industrial builders for an aluminum roofing and siding specifically adopted to factories, warehouses, storage depots, hangars, and similar structures. Alcoa states that the new Industrial Roofing will carry heavy loads and meet the exacting requirements of building codes.

Said to combine high strength, exceptionally high resistance to industrial atmospheres, minimum maintenance and reduced roof load, Alcoa Industrial Roofing will have a covering width of 32 in., allowing for a side lap of 1½ corrugations. It will come in standard five-ft through 12-ft lengths, .032 in. thick.

F-45—Improved Steam Hose

An improved "Burst-Proof" steam hose, widely used in many industries, is announced by the B. F. Goodrich Co., Akron, Ohio.

Principal improvement in the product is that the tube and cover do not harden so much after prolonged exposure to steam at the high pressures which are now being used in many installations, the company says.

ABSORB WAGE INCREASES

With This New Model C-20

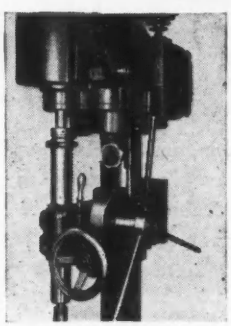
SIBLEY DRILLING MACHINE

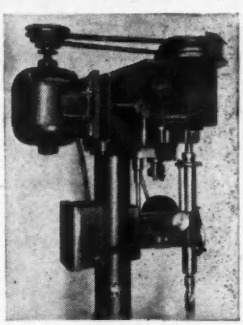
Compare time and motion studies on your present drilling and tapping equipment with the new 20" Sibley!

For operator efficiency, the new 20" Sibley is tops! Now introduced for the first time, it will cut your cost per piece on production; permit greater accuracy in your tool room.

Here is a shop machine designed by shop men. You have easy access to controls—turn a knob to select the proper geared power feed. A lever allows convenient shifting of V-belt. The 20" Sibley is a precision tool for sensitive drilling jobs at high speeds, and still has ample power to drill 1½" in mild steel. 8 spindle speeds range from 65 to 1360 RPM, driven by a 2 H.P. motor.

SEND FOR CATALOG NO. 15 NOW! Get complete information to compare with present equipment.





Convenient controls help to increase output.

Designed to help you challenge rising costs.

SIBLEY

MACHINE & FOUNDRY CORPORATION
206 E. TUTT STREET
SOUTH BEND 23, IND.

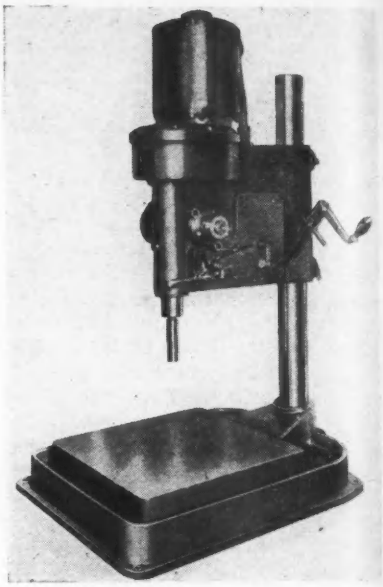
NEW Production and Plant EQUIPMENT

(*Continued from page* 50)

E-45—Compact Bench Tapper

A bench tapper of compact construction with selective full automatic cycle or hand operation with safety clutch which is said to reduce tap breakage to a minimum, is now in production at Buhr Machine Tool Co., 837 Green St., Ann Arbor, Mich.

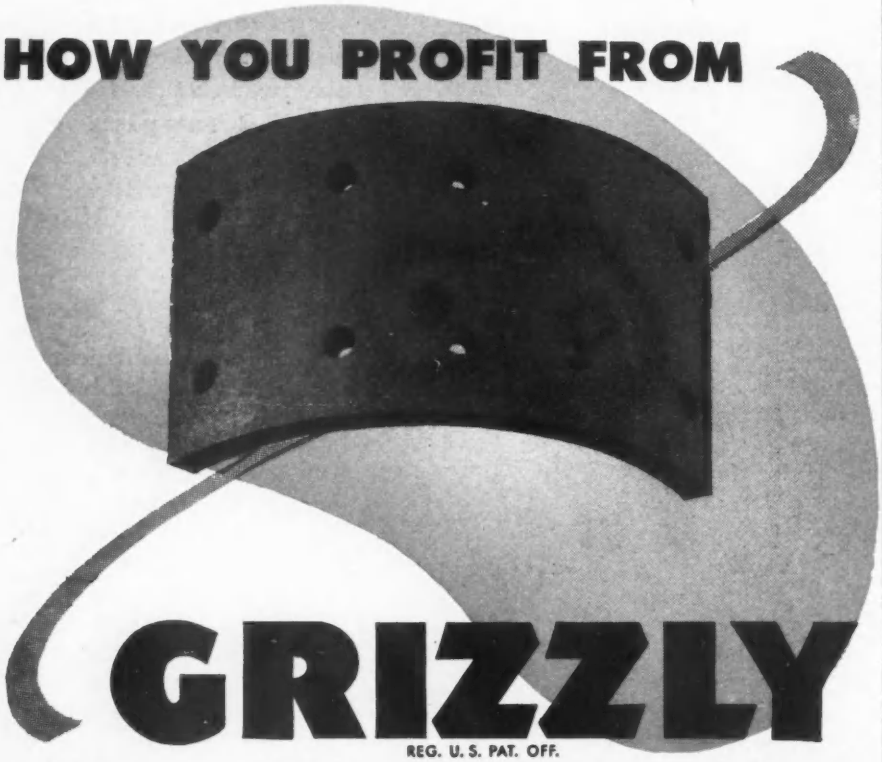
Change gears make all threads possible in tap diameters from No. 4 to 5/16 in. in cast iron, or ¼ in. in steel, with Class 3 fits under normal conditions. The ball bearing motor is 1/3 hp, 1800 rpm, 3 phase, 220 volt. Dimensions of the tapper are, swing, spindle to column, 10⅞ in. clear; spindle diameter, 1⅝ in.; maximum vertical travel 2 7/16 in.; base 17 in. by 22½ in. with coolant trough. The solid 2¼ in. dia. column may be replaced with one of extra length should the standard 15¼ in. clearance under spindle be insufficient for certain requirements.



Buhr bench tapper

Design follows the Buhr practice with ball bearings used where possible, a splined spindle and shaved, spline-broached and induction hardened gears. Base and head are heavy cast iron.

HOW YOU PROFIT FROM



GRIZZLY

REG. U. S. PAT. OFF.

BRAKE LINING EXPERIENCE

Grizzly has produced fine quality brake lining for over 30 years, and the experience gained through these years pays rich dividends to Grizzly users.

Experience, in both automotive and industrial fields, has enabled Grizzly to solve brake lining problems of widely divergent natures. Grizzly experience has been of utmost value in Grizzly research and study of new brake lining developments, and this same experience has helped establish Grizzly as one of the largest, most dependable producers of molded brake lining.

Do as other production, engineering and purchasing men have long been doing —take your brake lining problems to Grizzly. Get full advantage of Grizzly's many years of brake lining experience.

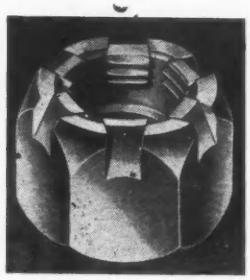
GRIZZLY MANUFACTURING COMPANY
PAULDING, OHIO
PLANTS AT PAULDING AND BELL, CALIF.
Warehouse Stocks in Principal Cities

AIRCRAFT PRODUCTS

(*Continued from page* 52)

metal" and varying temperature accommodations (heat and cold) with aircraft usage permitted up to 450 F.

Lancing operations in the crest of the nut afford spring action and produce a vibration-proof grip by the "Hexlok," on the threads of the bolt. They will be available in a full range of sizes.



Boots nut

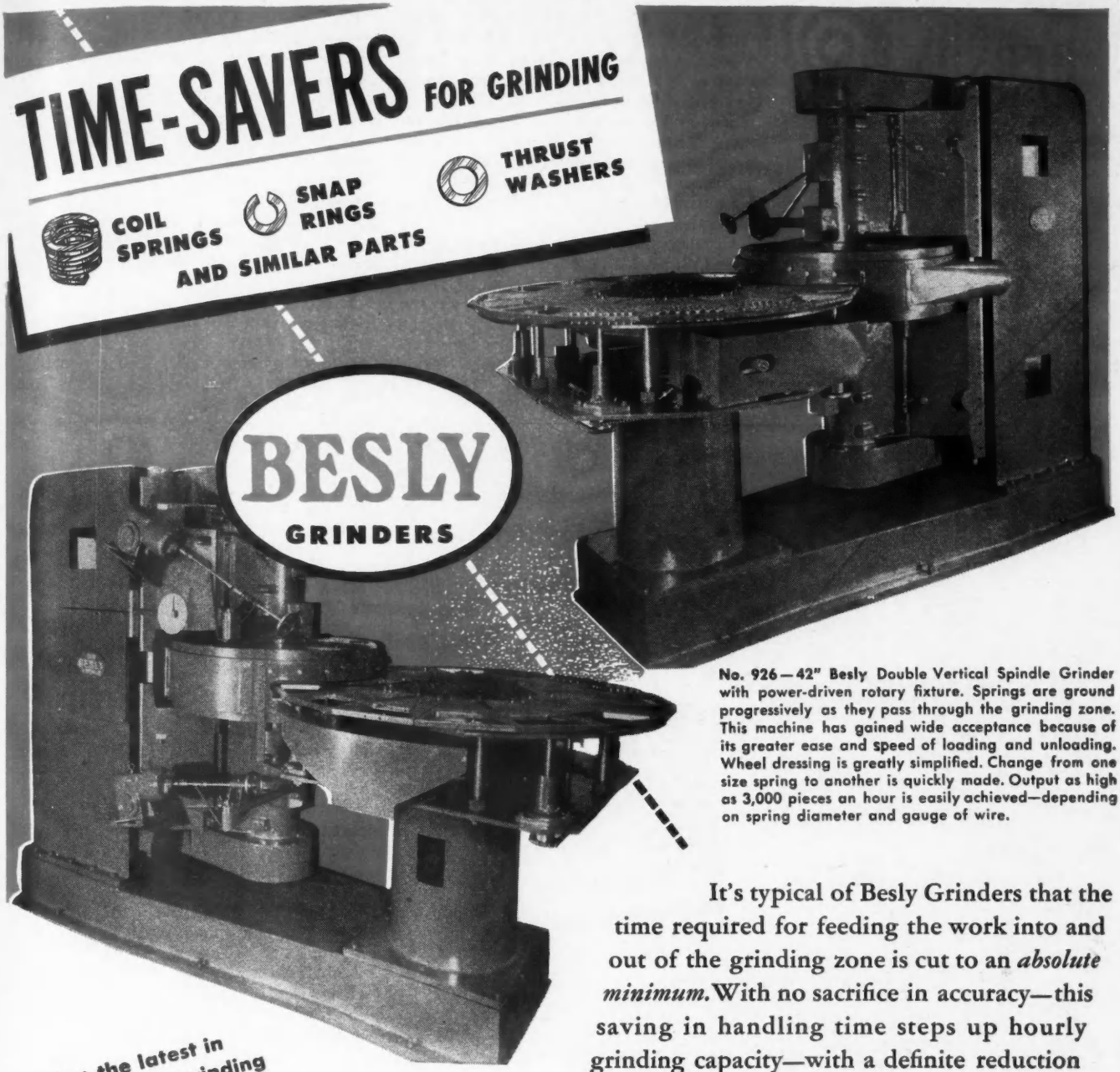
Changes in Ford Truck Prices

Ford Motor Co. truck prices were raised and lowered recently. Ranging from a slash of $17 to a boost of $98, truck prices were raised, J. R. Davis, Ford vice president, said because of "rising manufacturing and material costs." Ford passenger car prices were not changed.

TIME-SAVERS FOR GRINDING

COIL SPRINGS · SNAP RINGS · THRUST WASHERS
AND SIMILAR PARTS

BESLY
GRINDERS



No. 926—42" Besly Double Vertical Spindle Grinder with power-driven rotary fixture. Springs are ground progressively as they pass through the grinding zone. This machine has gained wide acceptance because of its greater ease and speed of loading and unloading. Wheel dressing is greatly simplified. Change from one size spring to another is quickly made. Output as high as 3,000 pieces an hour is easily achieved—depending on spring diameter and gauge of wire.

It's typical of Besly Grinders that the time required for feeding the work into and out of the grinding zone is cut to an *absolute minimum.* With no sacrifice in accuracy—this saving in handling time steps up hourly grinding capacity—with a definite reduction in unit production cost.

Besly Grinders are readily adapted to a wide variety of specialized work. Besly engineers—*with an accumulated experience of more than fifty years*—are ready to help you select the right grinder to increase your profits in the face of today's high production costs.

It will pay you to discuss your grinding operations with a Besly engineer. Write today!

See the latest in production grinding

1947 MACHINE TOOL SHOW
CHICAGO SEPT 17-26

BOOTH NUMBERS 275, 276, 277

BESLY BESLY GRINDERS AND ACCESSORIES
BESLY TAPS • BESLY TITAN ABRASIVE WHEELS

CHARLES H. BESLY AND COMPANY • 118-124 N. Clinton St., Chicago 6, Ill. • Factory: Beloit, Wis.

PERSONALS

Recent Personnel Changes and Appointments at the Plants of Automotive and Aviation Manufacturers and Their Suppliers.

Ford Motor Co.—**Joseph E. Patten,** named Supervisor of Plant Protection.

General Motors Corp., Oldsmobile Div.—**Carl F. Fischer,** Asst. Plant Mgr., Oldsmobile Forge Plant, **Harry A. Preece,** General Supt., in charge of Manufacturing Operations.

General Motors Corp. — **Robert E. Waldo,** Asst. to F. L. Burke, Vice-President in charge of the Accessory Group in General Motors.

Kaiser-Frazer Corp.—**Howard E. Carson,** Manager of company's business management and research dept.

Kaiser-Frazer Export Corp.—**Harold D. Ferguson,** Director of Latin American Sales.

Crosley Motors, Inc. — **William C. Byers,** Sales Manager.

Hupp Corp.—**Colonel Frank H. Higgins,** elected Vice-President, in charge of Detroit operations.

Tucker Corp. — **O. E. Hagemeyer,** Statistician and Sales Analyst.

Graham-Paige Motors Corp.—**George H. Bell,** Vice-President in charge of Distribution.

Stewart-Warner Corp. — **Gustave Treffeisen,** appointed Sales Manager of Alemite Distribution Div. **Kenneth W. Sickinger,** head of advertising, Radio Div.

General Motors Corp., Delco-Remy Div.—**H. D. Dawson,** Asst. General Manager; **Robert M. Critchfield,** Factory Manager, and **J. H. Bolles,** Chief Engineer.

E. I. duPont deNemours & Co.—E. S. **Nickerson,** General Manager of Fabrics and Finishes Dept.

Murray Corp.—**B. C. Gould,** elected Executive Vice-President.

Waukesha Motor Co.—**Charles E. Nelson, Jr.,** Asst. to the President, **James E. DeLong.**

Houdaille-Hershey Corp., Houde Engineering Div.—**Fred E. Ullery,** Executive Engineer and head of Engineering Dept.

The Federal Machine & Welder Co.—**A. R. Kelso,** appointed executive Vice-President of the Warren City Mfg. Co. and Warren Federal Machine & Welder Co., subsidiaries of Federal Machine & Welder Co.

The Parker Appliance Co.—**Nicholas Bashark,** Staff Engineer in charge of Aircraft Products.

Cummins Engine Co., Inc.—**S. J. Coffey,** Manager of Regions. **Byron A. Duling,** Manager of Engine Distribution.

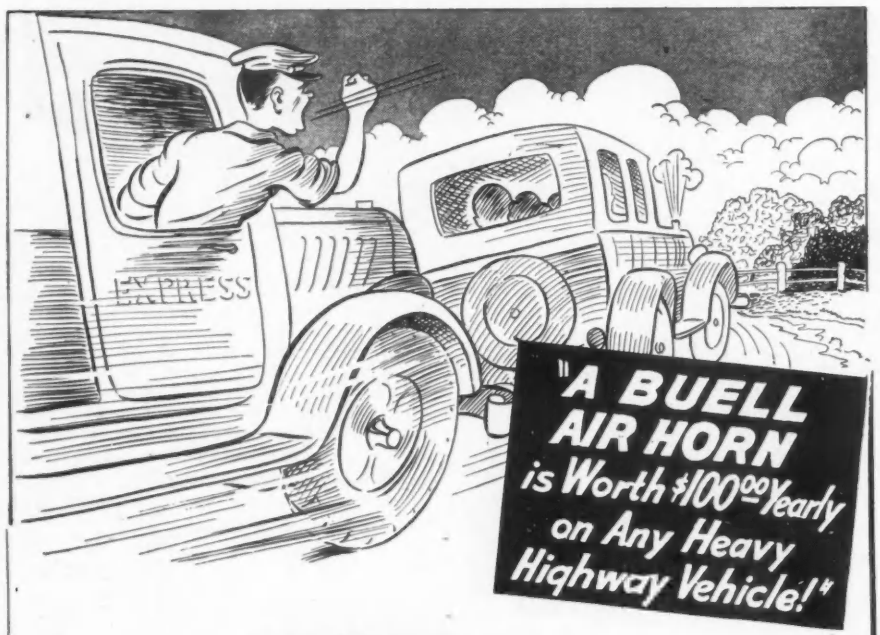
Heintz Mfg. Co.—**J. Marcus Ward,** elected Vice-President in Charge of Sales.

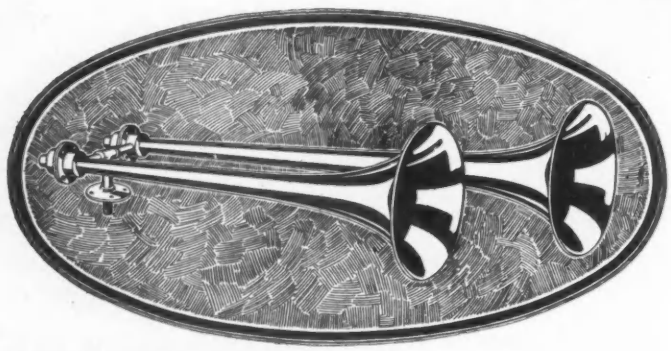
McCulloch Motors Corp.—**C. F. Breer,** Sales Manager.

Consolidated Vultee Aircraft Corp.—**Paul I. Stevens,** appointed Works Manager San Diego Div.

Aviation Maintenance Corp.—**John G. McKean,** elected to Board of Directors.

The Glenn L. Martin Co.—**D. Roy Shoults,** Chief Engineer.





- *Buell Air Horns are tops in warning signal efficiency.*
- *Installed as original equipment on many Trucks and Buses.*
- *They reduce maintenance costs by decreasing stops, starts and slowdowns.*
- *All records prove that they save tires, brakes, clutches and gears.*
- *Cut gas and oil consumption.*

With a Buell the driver has greater security, maintaining a steady cruising speed. Slowing a 20 ton load from 50 MPH to 30 MPH means destroying a lot of energy thru brake lining and *tires.* It is replaced by burning more gasoline, increasing load on engine and *tires* again, to regain speed. This all costs money. We believe a Buell Air Horn is worth $100.00 yearly on any heavy highway vehicle. Then remember a Buell will last more than 10 years. How would you rate a $100.00 investment that earned $100.00 yearly for 10 years. Ask the man who has a Buell.

BUELL MANUFACTURING CO.

2975 Cottage Grove Ave., Chicago 16, Ill.

Publications

(*Continued from page* 56)

specifications; aluminum casting alloys, di-metal for dies and punches, test bars, etc.

D-48—Die-Less Duplicating Machines

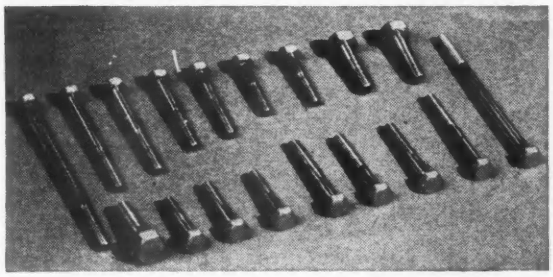
O'Neil-Irwin Mfg. Co. — Di-Arco Catalog No. 47-12 contains illustrations and specifications covering Di-Arco benders, brakes, shears and rod parters. Photographs showing various applications are included.

D-49—Paint-Zip

Turco Products, Inc.—4-page folder describes and illustrates the new Turco Paint-Zip for removing paint from both wood and metal surfaces without raising the grain or otherwise harming the surface.

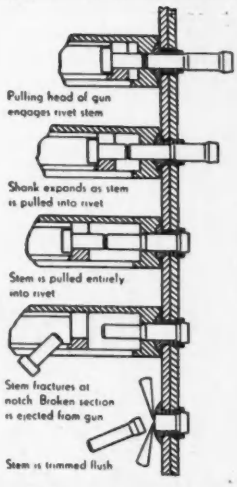
HOW MANY TIMES HAVE YOU WISHED FOR *FASTENINGS LIKE THESE?*

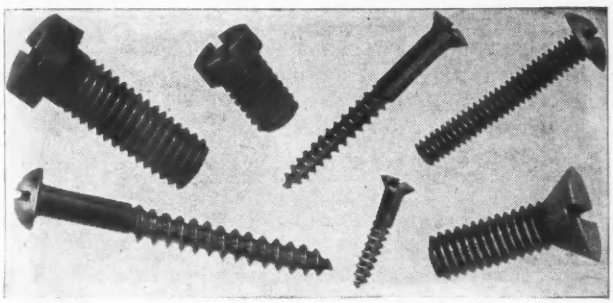
They're tough, strong, corrosion-resistant . . . and look at the wide variety . . . now available in INCO Nickel Alloys



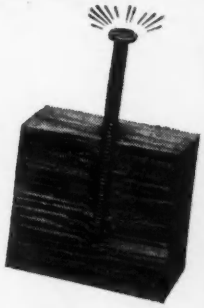
1. NUTS and BOLTS of Monel* and Nickel. They've plenty of toughness and strength to resist heavy twisting strains. Bolt heads stay sharp and clean cut. Maintenance men like their high corrosion-resistance . . . these fastenings keep their gripping power without "freezing" fast.

2. CHERRY RIVETS of Monel. These famous Cherry rivets need no bucking. Monel's high shear strength, ductility, and corrosion resistance make them ideal for tight long-lasting joints in trucks, tractor-trailers, buses, and airplanes.


Pulling head of gun engages rivet stem
Shank expands as stem is pulled into rivet
Stem is pulled entirely into rivet
Stem fractures at notch Broken section is ejected from gun
Stem is trimmed flush



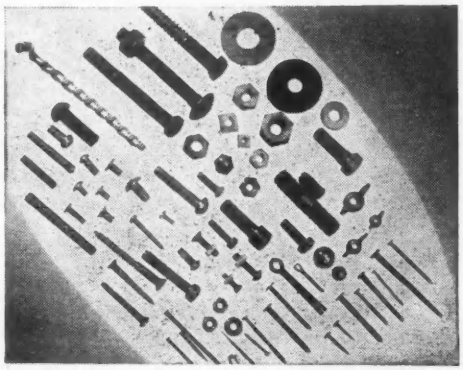
3. SCREWS of Monel and Nickel. Get strong, rustproof Monel and Nickel screws in any quantity you need. You can have shining round- or flat-head wood screws . . . cap screws, set screws . . . and many others. They all offer extra strength, extra long life. And, they'll not spot or discolor metal finishes or coatings.



4. ANCHORFAST* Nails of Monel. ANCHORFAST nails that hold like screws are also available in strong, corrosion-resistant Monel . . . in quantity. When you drive an Anchorfast nail home, scores of wood fibers become tiny wedges to grip the nail shank.

• • •

Says one automotive manufacturer: *"Anchorfast nails of Monel are preferred to screws for attaching metal linings to trailer interiors."* Another reports: *"Using these nails on critical joints on truck bodies helps solve vibration problems."*



5. SPECIAL FASTENINGS—Monel, Nickel, Inconel. Whatever kinds of fastenings you need, you can get them of Monel and Nickel. Available are screws, nails, brads, rivets, cotter pins, and washers . . . all the well-known types . . . in all regular sizes. Special Monel fastenings can also be made to your own designs.

Whenever high temperatures, corrosive conditions, vibration, heavy loads . . . or a combination of any or all four must be met by a single fastening . . . *make sure that fastening is an INCO Nickel Alloy.*

Your nearest INCO distributor, listed below, can supply you immediately. Call him today.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

*Reg. U. S. Pat. Off.

ORDER INCO NICKEL ALLOY FASTENINGS FROM:

WHITEHEAD METAL PRODUCTS COMPANY, Baltimore, Boston, Buffalo, Newark, New Haven, New York, Philadelphia, Rochester, Syracuse.
WILLIAMS AND COMPANY, INC., Cincinnati, Cleveland, Columbus, Pittsburgh, Toledo.
STEEL SALES CORP., Chicago, Detroit, Indianapolis, Milwaukee, Minneapolis, St. Louis.
PACIFIC METALS COMPANY, LTD., Los Angeles, San Francisco, Salt Lake City.
J. M. TULL METAL & SUPPLY CO., Atlanta.
EAGLE METALS CO., Portland, Seattle.
METAL GOODS CORPORATION, Dallas, Houston, New Orleans, Tulsa.
HENDRIE & BOLTHOFF M. & S. CO., Denver.

What Is the Actual Demand for Cars?

(*Continued from page* 46)

the year was covered by a net reduction for the year in holdings of bank deposits and Government bonds of the buyers.

Fully as many consumers plan to use installment credit in purchasing durable goods during 1947 as did in 1946. Fewer buyers, however, used installment credit during 1946 than had indicated they would do so at the beginning of the year. This year if more consumers planning to buy new automobiles, refrigerators, washing machines and other durable items are successful in their buying plans, there is the likelihood that the volume of installment sale credit will expand at a more rapid rate than during 1946, and that use of liquid assets for these purposes will be greater. Price increases in the past year may be a factor in causing more prospective purchasers to consider it necessary to use some part of their asset holdings or to borrow, if they fulfill their intentions to purchase, than was the case in 1946.

Among the people who expect to buy automobiles in 1947, fewer of those who plan to buy new cars contemplate using credit than of those intending to buy used cars. While 59 per cent of the new car buyers plan to pay all cash for their cars, only 45 per cent of the used car buyers expect to do so.

Among the prospective buyers of automobiles and other durable goods who contemplate borrowing to finance their purchases, the average amount expected to be borrowed is $380.

Tables 4 and 5 contain additional information concerning some of the preliminary findings presented in the text.

for sweet-running motors . . .

Design with

DOLE

Thermostats

— in a range of types for every car

Positive motor temperature control — the basic function of Dole Thermostats — is a simple but realistic aid to reputation-winning performance. Dole Thermostats provide quick warm-up *at all seasons* — plus appreciable savings in gas, oil and motor wear.

THE DOLE VALVE COMPANY

1901-1941 Carroll Ave., Chicago 12, Illinois

Los Angeles Detroit Philadelphia

Ford Utilizes Extrusion Method

(*Continued from page* 31)

ing as some time often elapsed before the gears were assembled into a pump.

The restriking operation, essentially an extrusion process, incorporated a new idea concerning the function of the core rod in the sizing operation, and the use of an extrusion plate through which the part was sized externally. The restriking tools, shown in their relative positions in Fig. 7, consisted of a top core rod, top punch, guide nest, extrusion plate, die body, lower punch and lower core rod. The gear was forced through the extrusion plate where it expanded in the solid die and then was extruded from the die back through the plate. The extrusion plate was made of high-chromium high-carbon steel; and the broaching hole was chromium plated to compensate for wear.

The top core rod was passed through the gear before it was pressed into the die, and the bottom punch was held in the ejection position with springs which allowed the core rod to pilot into it and remain all during the restriking operation. This method overcame the tendency of the part to become eccentric. With the core rod piloted into the lower punch, the metal of the gear was forced to form a concentric hole.

The lower core rod was inserted in the gear hole from the bottom as the top core rod was withdrawn. This arrangement prevented the gear hole from becoming tapered, and permitted extrusion through the sizing plate and over the lower core rod.

Using these tools designed for extrusion restriking it was possible to produce this gear up to lengths of 1¾ in. Other parts whose ratio of length to hole diameter was on the order of 9 to 1, have been produced with eccentricities on the order of 0.07 of one per cent of the length.

These tools may be produced at a lower first cost, have a low maintenance and produce parts to closer tolerances than is the case with conventional tools.

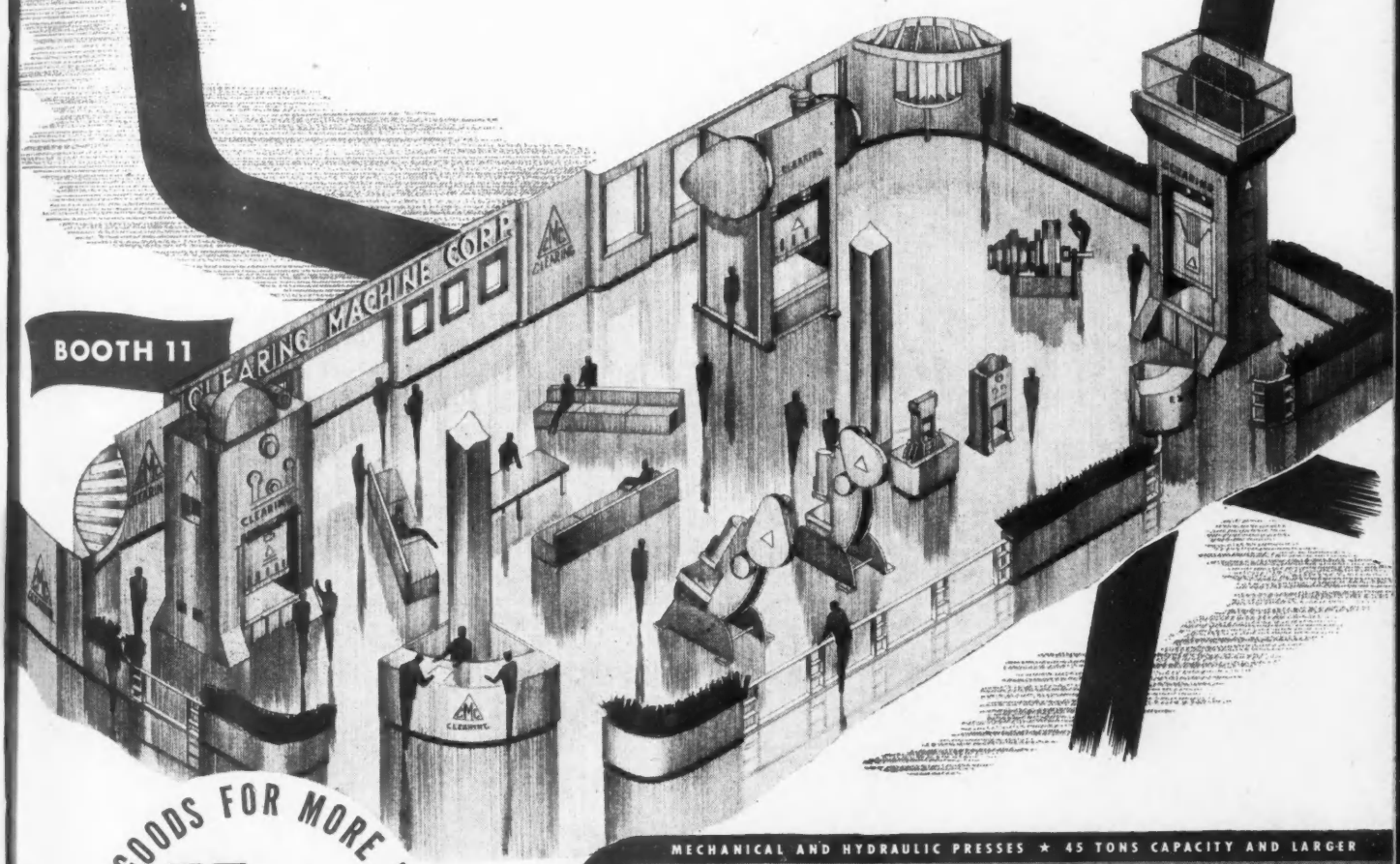
ACRES OF IDEAS

for Cutting Production Costs

The Machine Tool Show in Chicago September 17 to 26 affords an unparalleled opportunity to see and compare ways and means to reduce the cost of producing the things the world needs for better living. No industrial executive with his eye on the markets of tomorrow can afford to miss the information, the new ideas, and the practical examples so conveniently gathered together under one roof.

Clearing Machine Corporation is prepared to make its share of the show particularly worth while to those interested in producing large quantities of anything in metal or certain other materials. Clearing presses of various sizes, mechanical and hydraulic, will be there for examination—but equally important, Clearing engineers will be on hand during all show hours to talk about your specific needs and problems.

Even if you hadn't thought of *presses* as a means to lower your production costs, it might pay you to drop into Booth No. 11 while you're at the show.



BOOTH 11

MORE GOODS FOR MORE PEOPLE AT LOWER COST

MECHANICAL AND HYDRAULIC PRESSES ★ 45 TONS CAPACITY AND LARGER

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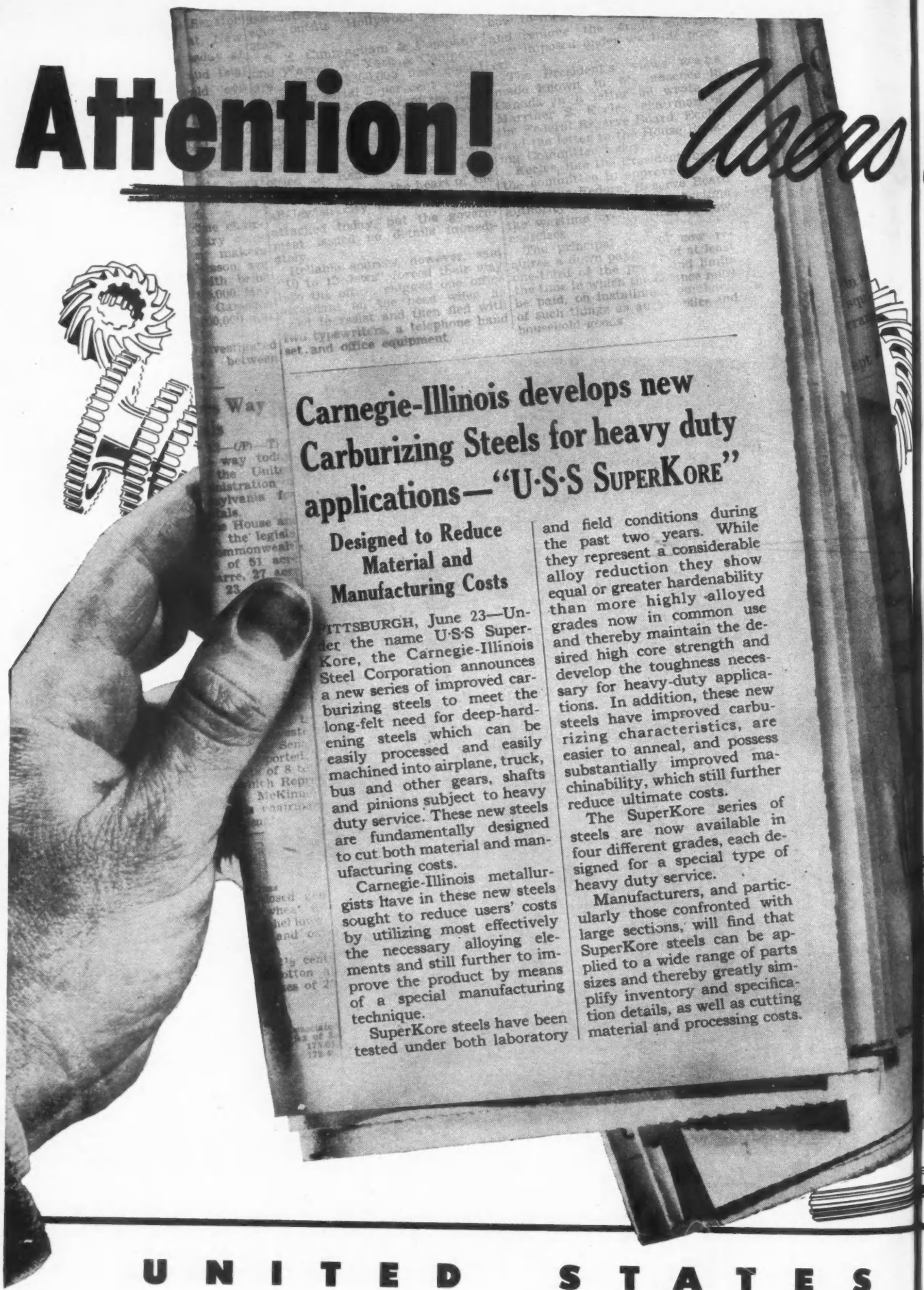

Carnegie-Illinois develops new Carburizing Steels for heavy duty applications—"U·S·S SuperKore"

Designed to Reduce Material and Manufacturing Costs

PITTSBURGH, June 23—Under the name U·S·S SuperKore, the Carnegie-Illinois Steel Corporation announces a new series of improved carburizing steels to meet the long-felt need for deep-hardening steels which can be easily processed and easily machined into airplane, truck, bus and other gears, shafts and pinions subject to heavy duty service. These new steels are fundamentally designed to cut both material and manufacturing costs.

Carnegie-Illinois metallurgists have in these new steels sought to reduce users' costs by utilizing most effectively the necessary alloying elements and still further to improve the product by means of a special manufacturing technique.

SuperKore steels have been tested under both laboratory and field conditions during the past two years. While they represent a considerable alloy reduction they show equal or greater hardenability than more highly alloyed grades now in common use and thereby maintain the desired high core strength and develop the toughness necessary for heavy-duty applications. In addition, these new steels have improved carburizing characteristics, are easier to anneal, and possess substantially improved machinability, which still further reduce ultimate costs.

The SuperKore series of steels are now available in four different grades, each designed for a special type of heavy duty service.

Manufacturers, and particularly those confronted with large sections, will find that SuperKore steels can be applied to a wide range of parts sizes and thereby greatly simplify inventory and specification details, as well as cutting material and processing costs.

UNITED STATES

s of Carburizing Steels

U·S·S SUPERKORE STEELS—properly applied—have the following advantages...

—they cost less than more highly alloyed carburizing steels.
—they improve hardenability . . . give deeper hardening.
—they reduce inventories necessary to do the job with present steels.
—they are easier to anneal.
—they have improved machinability.
—they have improved carburizing characteristics.

U·S·S SUPERKORE STEELS were developed to meet *specific* fabricating and performance requirements. That's why it is important that SuperKore Steels be properly applied.

To get the full benefit of these steels in reducing the costs of your heavy-duty gears, shafts and pinions, the help of our service metallurgists —who developed U·S·S SuperKore Steels— is available to assist you in putting them to work on the right jobs, and to iron out any application problems involved in their use.

The new "SuperKore Booklet" provides further information on these steels. For your copy write direct to Carnegie-Illinois Steel Corporation, Carnegie Building, Room 470, Pittsburgh 30, Pennsylvania.

CARNEGIE-ILLINOIS STEEL CORPORATION

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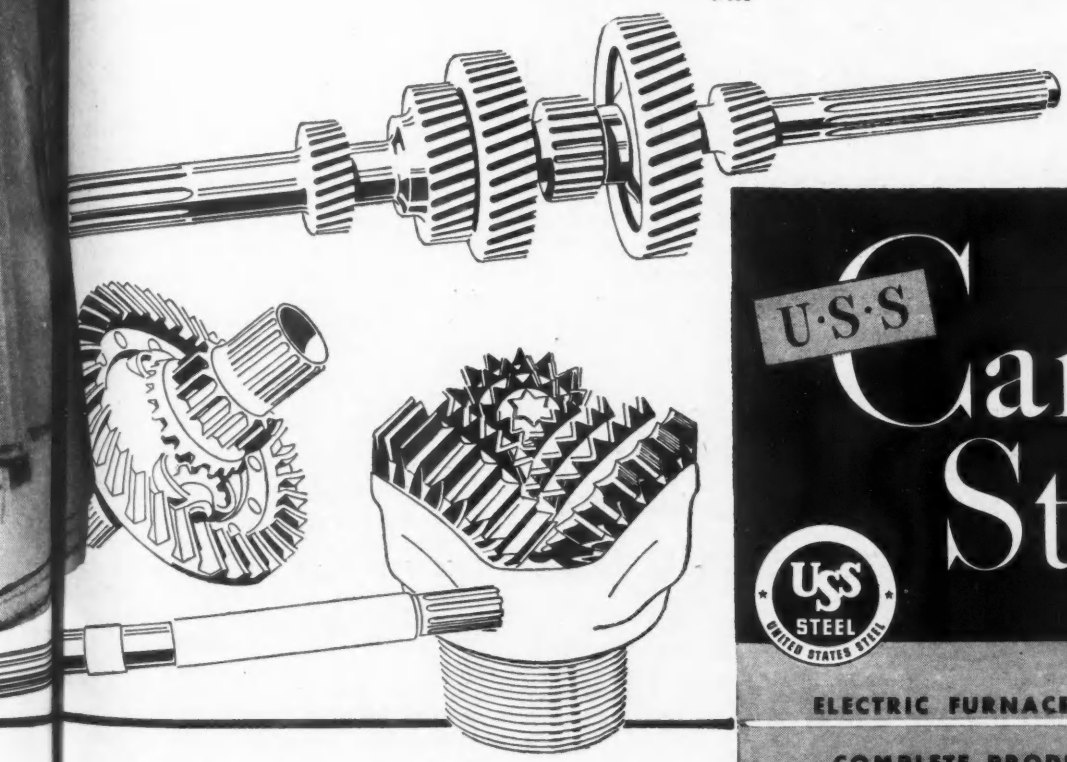


U·S·S Carilloy Steels

USS STEEL — UNITED STATES STEEL

ELECTRIC FURNACE OR OPEN HEARTH

COMPLETE PRODUCTION FACILITIES IN CHICAGO AND PITTSBURGH

S T E E L

Helicopter Power Plant Problems

(*Continued from page* 41)

has been to engines with crankshafts vertical. This position of the engine permits maximum simplicity in the rotor drive and, particularly in the case of the opposed type engine, favors the concentration of weight near the center of lift of the rotor. It has, however, introduced complications in the operation of the engine. The first problem is that of lubrication, not in supplying the lubricant to the working parts, but in collecting and disposing of the return oil without excessive agitation, heating, foaming and leakage into the lower accessories.

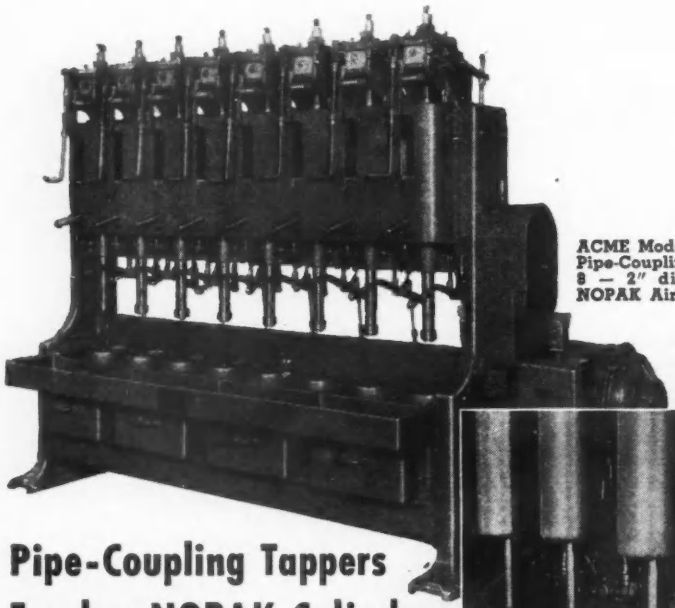
It has been the experience of several manufacturers of engines with vertical crankshafts that return oil draining down around cylinder barrels and through rapidly moving crank throws, connecting rods and accessory gears suffers excessive temperature rise, produces foaming and generally aggravates an already difficult breathing and accessory sealing problem. The use of partially shielded drainage passages to direct oil away from moving parts and hot surfaces and the adoption of deep oil sumps and double oil seals for the accessories has gone far in relieving this trouble. This situation, however, illustrates a too common experience in the adaptation of aircraft engines to new applications. What appeared at the outset to be a minor alteration in the operating condition of the engine which would be of considerable benefit to the helicopter designer has produced operational difficulties which, in the end, make necessary rather important structural changes in the engine. Consequently what was to have been an extension of the market for a standard commercial article now is an entirely new specification with corresponding disappointments in the matter of cost. Obviously, as the volume requirements of the helicopter market increase, the price disadvantage will diminish. But in present circumstances, efforts on the part of the helicopter designer to make use of existing aircraft power plants with only minor external modifications might pay handsome dividends in manufacturing costs. It is worth noting that the radial engine operating with crankshaft vertical requires special accessory seals, but does not suffer from the oil churning and overheating troubles or breathing difficulty experienced by the opposed engine.

Engine Cooling

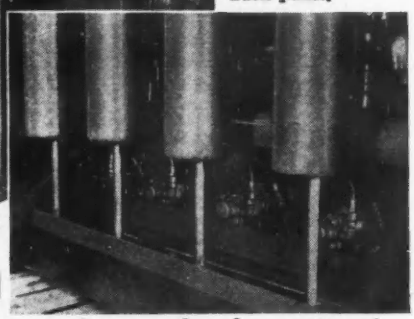
By far the most obvious and generally recognized helicopter power plant problem is that of cooling an engine in a vehicle which has no flight induced cooling draft. The most valuable maneuver of the helicopter is that which demands full engine power and provides no vehicle velocity. The power plant, therefore, by one means or another, must provide its own cooling. Two means are available for that purpose, the engine driven fan and the exhaust ejector. The engine driven fan at present is by long odds the preferred method, though exhaust ejector cooling has made remarkable progress in recent months.

Two general methods of fan drive are current: the fan mounted on the power shaft of the engine and forcing the air axially to the cylinders; and the fan mounted on a supplementary shaft at right angles to the crankshaft and blowing transversely across and between the cylinders. The relative advantages of these methods are largely those of convenience and, therefore, vary in different installations. The crankshaft mounted fan has the virtue of simplicity both in manufacture and in dy-

(*Turn to page* 78, *please*)



ACME Model XT-C, 8-spindle, Pipe-Coupling Tapper employs 8 — 2" diameter, Model F NOPAK Air Cylinders.



Close-up shows how NOPAK Cylinders are mounted on back panel.

Pipe-Coupling Tappers Employ NOPAK Cylinders for Fast, Positive Chucking

One of the features which contributes to the speed and capacity of Acme Pipe-Coupling Tappers is the self-centering air chucks which grip and position the couplings during the tapping operation.

These chucks are individually actuated by NOPAK Air Cylinders mounted behind each spindle. Downward and upward movement of the spindles operates the air valves which control the chucks ... gripping and releasing the couplings as required, automatically.

This is but one of many applications in which NOPAK Cylinders, Air or Hydraulic, supply the motive power for fast, positive machine movements. Write for Bulletin 92.

GALLAND-HENNING MFG. CO., 2774 S. 31st Street, Milwaukee 7, Wis.

Representatives in Principal Cities

NOPAK
VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE

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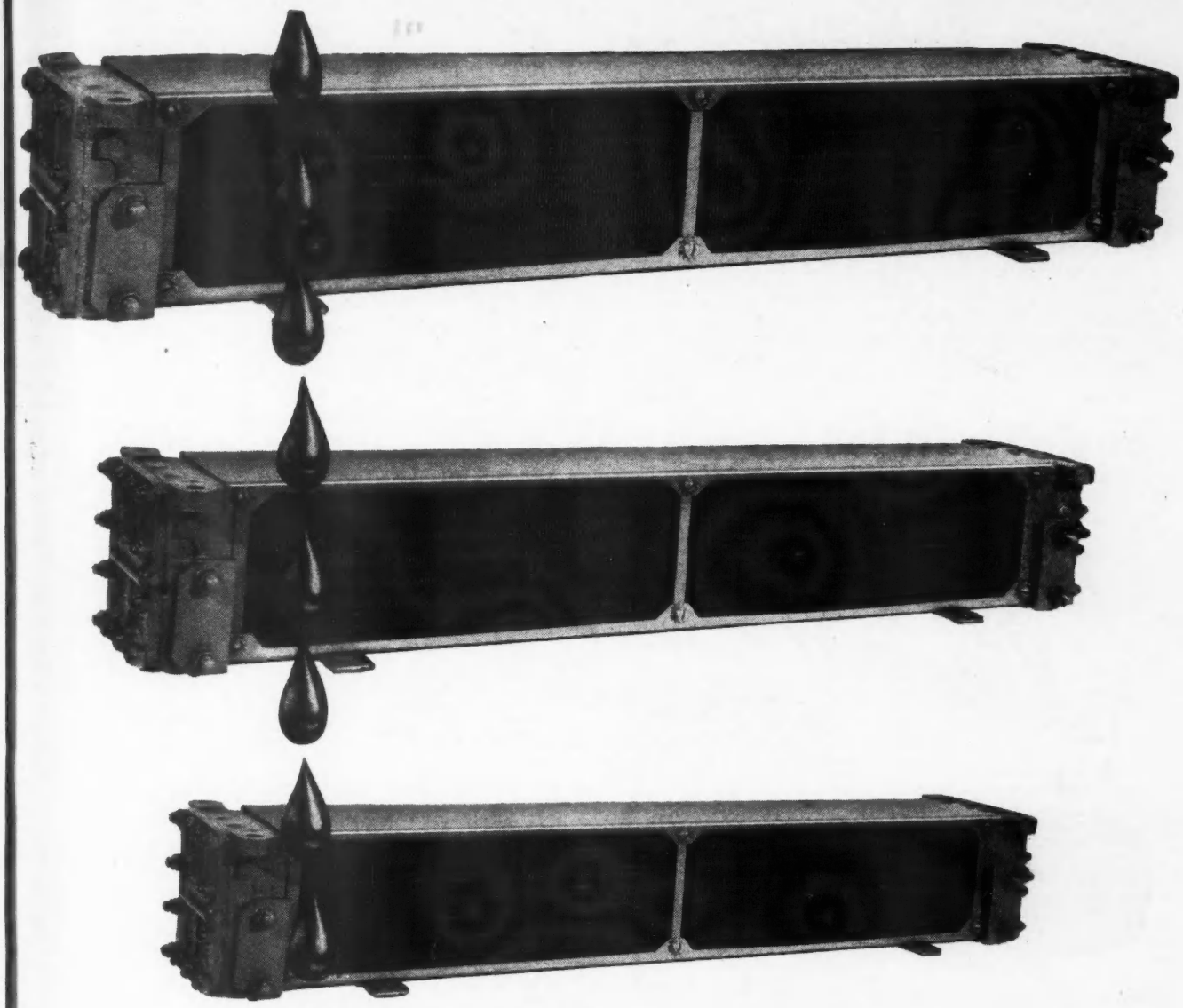


Efficient OIL COOLING

Special design and quality workmanship are combined in this better oil cooler for bus engines. An important maintenance advantage is the easily removable head for tube cleaning.

Oil coolers of this type are designed for each particular application and therefore are not a standardized product. They are manufactured only in production quantities for your particular oil cooling needs.

A PRODUCT OF B-W BORG-WARNER

LONG MANUFACTURING DIVISION

BORG-WARNER CORPORATION

Detroit 12, and Windsor, Ontario

LONG

CLUTCHES • RADIATORS • OIL COOLERS

Power Plant Problems

(*Continued from page 76*)

namic behavior; but the transverse fan, because of the latitude in operating speed and dimensions, is likely to have somewhat better efficiency. In an installation which requires that the engine be suspended from the gear box, the crankshaft mounted fan will offer clumsy though perhaps not prohibitive interference, whereas the transverse fan with its lateral protuberance may be no less difficult to accommodate in other installations.

Operational Characteristics

The advantageous peculiarities of helicopter performance impose unusual power plant operation requirements: vertical ascent, hovering and vertical descent during landing operation. All of these call for full engine power. Moreover, two of these three important operations are carried on in circumstances which would make engine failure extremely distasteful. Also, the helicopter rotor is essentially a constant velocity wing and so requires the engine to produce all of its power at practically full power speed. This situation is further aggravated by the effect of atmospheric density reduction at altitude which calls for overspeed capacity of at least 10 per cent to prevent rotor stall. These conditions, imposed upon an engine which has already been increased in speed to improve its power-weight factor, present problems in valve gear and bearing development which not many months ago were not recognized as part of the program of helicopter propulsion. In this respect, current helicopter engines fall somewhat short of satisfying the desires of rotary wing designers; and this problem, therefore, deserves greater attention from the engine industry.

Dynamics

The dynamic peculiarities of the most complex helicopter power train can be resolved on paper with sufficient accuracy to disclose any dangerous resonant conditions. The cost of such an analysis, though frequently fairly staggering, is invariably but a fraction of the price of the delay and damage resulting from even a minor accident.

The necessity of starting and operating helicopter engines declutched from the power train is an unfortunate circumstance. Many engines will start and idle satisfactorily with very small flywheels, but if such engines are fitted with high-speed supercharger impellers or cooling fans there is likelihood of severe damage to intermediate drives resulting from accelerations of cylinder firing impulses and the inertia of the high speed impellers. A disappointingly large weight in the flywheel is required to absorb the torque variations and protect the accessory drives during such operation.

engineered for

Thorough DEPENDABILITY..

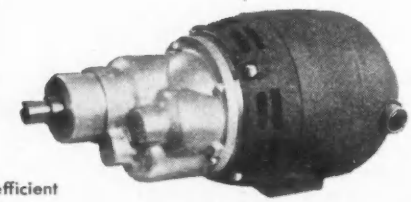
Lamb Electric MOTORS

A compact motor, particularly suitable for computing machines and other types of motor-driven office equipment.

Exacting manufacture backed by *thorough engineering* gives Lamb Electric motors long, trouble-free operation conducive to satisfactory product performance. Because of this standard of dependability, Lamb Electric motors are being teamed up with more and more of America's finest products.

THE LAMB ELECTRIC COMPANY
KENT, OHIO

Rugged construction is a major factor in the reliability of this motor widely used in the field of mechanized equipment.



Light-weight universal motor with efficient spur gear speed reducer.

Lamb Electric SPECIAL APPLICATION FRACTIONAL HORSEPOWER MOTORS

Du Pont Develops Neoprene Whitewalls

Neoprene white sidewall tires, developed by E. I. du Pont de Nemours and Co. (Inc.), stay whiter longer without cracking and retain a new tire look longer than natural rubber sidewalls, according to a five-year continuous service test by du Pont.

Nearly 200 Laboratories For Automotive Industries

According to an AMA survey, there are nearly 200 research laboratories in the parts, vehicle, rubber, and petroleum industries. They employ 1931 chemists; 3769 engineers; 574 metallurgists; and 281 physicists. The research groups make available 45 research grants and 39 research fellowships annually.

TO THE MANUFACTURER WHO WANTS TO

CUT COSTS WITHOUT CUTTING QUALITY

Johnson Bronze Sleeve Bearings Give You Every Worthwhile Advantage

- LOW COST
- PRECISION
- QUIET
- LONG LIFE
- CORROSION RESISTANT
- UNIT CONSTRUCTION
- LOAD CARRYING CAPACITY
- HIGH RESISTANCE TO SHOCK
- LOW COEFFICIENT OF FRICTION
- EASY TO INSTALL
- CONFORMABILITY
- NATION WIDE SERVICE

MOST manufacturers find themselves in a critical situation today. Material and labor costs are still advancing. Competition is becoming keener. Some ways must be found to keep finished product prices from going higher. Manufacturers realize that the one who can produce the most efficient unit at the lowest price will command the market.

The low unit cost of Johnson Bronze Sleeve Bearings can make a substantial savings in many cases. You will be pleasantly surprised at the economies possible through the wider use of Sleeve-Type Bearings. Yet this does not mean a compromise with quality and performance. It is simply a matter of selecting the right bearing for each application. Johnson Bronze will be glad to study your needs . . . will make recommendations . . . based on facts . . . free from prejudice. Take advantage of our wide and varied experience in assisting manufacturers of all types of equipment. Write us . . . or phone your nearby Johnson Bronze representative.

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JOHNSON BRONZE
SLEEVE BEARING HEADQUARTERS

Special Machinery for High-Volume Output

(*Continued from page 27*)

Fig. 1, is an electronically controlled unit for the automatic contour turning of the housing cavity. The cavity is intricately formed with a radius front and rear connected with a tangential straight section in between. Spicer engineers designed and built this machine themselves, developing at the same time the mechanism for the contouring tool and its electronic controls. The only familiar element of this equipment is a Gisholt Simplimatic bed which forms the backbone for the machine. The massive tool block is mounted on a rotary table which is revolved in a timed cycle. The tool holder is fitted with a cross-slide which comes into play when machining the straight portion of the cavity. The tool is tipped with a special grade of Carboloy.

The pump rotor of the torque converter has a concave shape in the form of a continuous curve which is machined at an extremely high rate in a special Ex-Cell-O contouring machine having an electrically controlled hydraulic mechanism. The tool used on this machine also is tipped with a special grade of cemented-carbide. Two Ex-Cell-O's are used on this job, one for roughing and the other for finishing.

Submerged arc welding, a relatively new technique, has been harnessed for the solution of a number of unusual fabrication jobs. The turbine rotor for example, has a flanged part of fairly large diameter terminating in a splined stub shaft. Ordinarily the part would be made as a large forging requiring expensive dies, special normalizing and heat treating stages, and involving considerable metal removal. With submerged arc welding, the flanged portion is made as a press stamping, and the stub end is produced as a simple machined forging. Then the two are joined by welding into an assembly in which the welded joint is stronger than the part itself. The same technique is employed in making the large Zerol output gear. The gear section is forged and machined separately, then welded to a splined stub shaft after the latter has been completely finished.

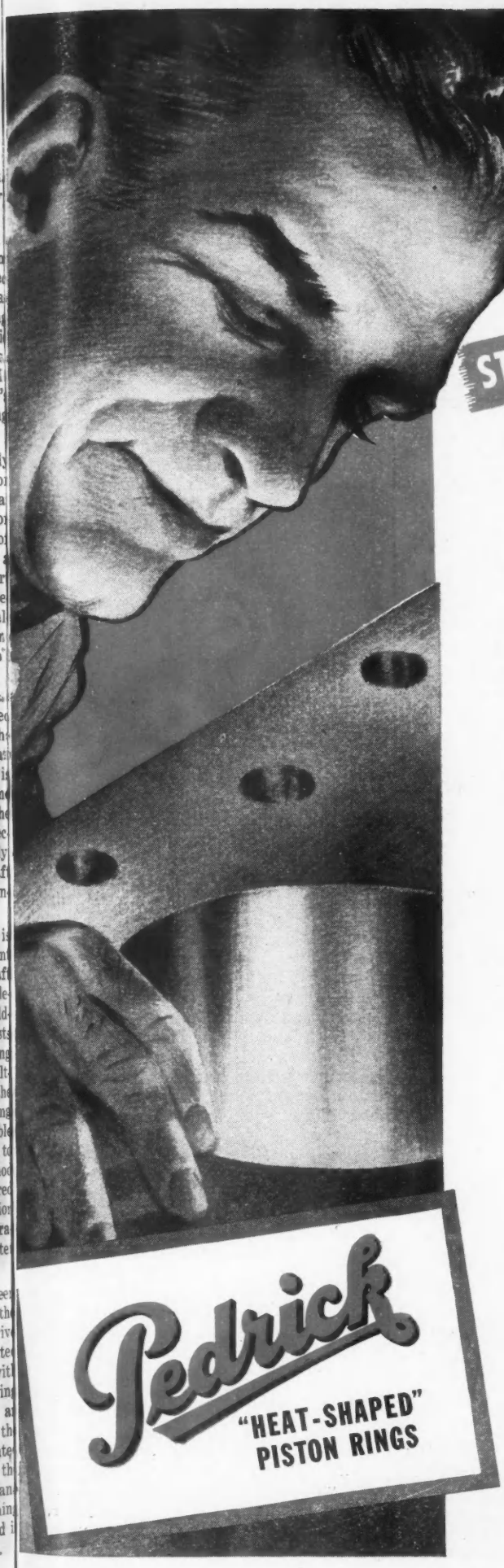
Another noteworthy application is found in the joining of propeller joint ends to the tubing for propeller shaft assemblies. Spicer engineers have developed their own submerged arc welding machine (see Fig. 2) which consists of two Lincolnweld automatic welding heads. The headstock contains a built-in cam mechanism for controlling the welding cycle as well as for rotating the work. The tail-stock is adjustable for length as on a lathe. According to Spicer the advantages of this method are: increased welding speed compared with conventional practice, better fusion and deeper and more uniform penetration, freedom from porosity, a flatter weld bead, and no weld spatter.

An interesting advance has been made in turning axle shafts with the introduction of a special center-drive lathe built by Snyder. As illustrated in Fig. 3, the machine is arranged with tool blocks at each end for forming both ends simultaneously, and has an attachment at one end for turning the taper. Cutting is done with cemented carbide tools. Unique feature of the machine is its extreme massiveness and rigidity which assures true machining of both ends of the shaft. Its speed is said to exceed conventional practice.

The slip-on-the-transmission-shaft feature permits the spline, on this MECHANICS Roller Bearing UNIVERSAL JOINTS and tubular shaft assembly, to be lubricated by the lubricant in the transmission — eliminating the conventional reservoir and stub shaft. Let our engineers show you how this and other MECHANICS features will help you reduce weight and costs in your new model.

MECHANICS

MECHANICS UNIVERSAL JOINT DIVISION
Borg-Warner
2020 Harrison Avenue, Rockford, Ill. Detroit Office, 7-234 G. M. Bldg.



Brand new engine . . . Wide open throttle . . . STILL NO SCUFFS on cylinder walls!

Engine-builder's tests show Pedrick "Silcoated" Piston Rings are faster-seating . . . easier on cylinder walls

EARLY IN 1946, an engine manufacturer experienced an unusual degree of trouble in scuffing and scoring of cylinder walls during the running-in period. Rings in use were phosphate-coated.

Seeking to solve the problem, the manufacturer made comparative tests of phosphate-coated rings, tin- or cadmium-plated rings, and Pedrick "Silcoated" Rings, using brand new engines. Test routine was as follows:

DURATION	SPEED	LUBRICANT
10 minutes	1,000 R.P.M.—no load	Break-in oil
10 minutes	1,100 R.P.M.—no load	Break-in oil
10 minutes	1,200 R.P.M.—no load	Break-in oil
15 minutes	4,500 R.P.M.—full throttle	SAE #40

RESULTS: Extensive scuffing with phosphate-coated rings; *no scuffing* attributable to tin- or cadmium-plated rings or to Pedrick "Silcoated" rings.

EXPLANATION: The "Silcoating" process, exclusive with Pedrick, produces on the piston ring a soft, velvet-like surface containing iron oxide, iron sulphate, and graphite. As a result of the graphitic content, this surface has high lubricating qualities in itself. In addition, since it is porous, it soaks up and holds oil. Abrasive metal-to-metal contact between rings and cylinder wall is avoided. Scuffing is prevented. Engines reach peak efficiency sooner.

ANOTHER POINT: Because Pedrick Rings are "Heat-Shaped," they retain peak efficiency *longer*. They save gas, they save oil, and they are easy on the cylinders.

WILKENING MANUFACTURING CO., Philadelphia 42, Pa.
In Canada: Wilkening Manufacturing Co. (Canada) Ltd., Toronto.

Chevrolet's New Flint Plant

(*Continued from page* 26)

from the Chevrolet manufacturing plant in Flint as finished and inspected, but require the mounting of various accessories. This is done on the motor assembly conveyor, another monorail line, which feeds the final line at the engine drop. An interesting feature here is the double checking of valve adjustment right on the conveyor. To this end there are two overhead mounted electric motors which line up with the engine crankshaft for motoring at a moderate speed, permitting the operators to check and adjust valve lash. Both the passenger car and truck final lines are served by body drops from the second floor gallery in conventional manner.

The end of the line has a new piece of equipment for adjusting headlamps. Cars are driven onto a pair of tracks fitted with a pneumatic spreader which lines them up in the fixture. Headlamp aiming then is done with the aid of photoelectric cells which indicate the light intensity and insure proper adjustment.

A modern paint mixing room handles the mixing and circulation of 14 standard colors used for finishing passenger car sheet metal as well as sheet metal and bodies for the truck division. The use of modern equipment for agitation of paint, control of viscosity, scientific control of blending, and a suitably controlled pump circulating system to the various spray booths combines to give excellent control of color and an unvarying match with the body colors produced in the Fisher body paint shop.

An important management feature is the installation of storage conveyors for painted sheet metal parts. Eventually all sheet metal parts will be kept in circulation on these conveyors, eliminating storage bays, reducing handling, and above all preventing the hazard of scratched or marred parts.

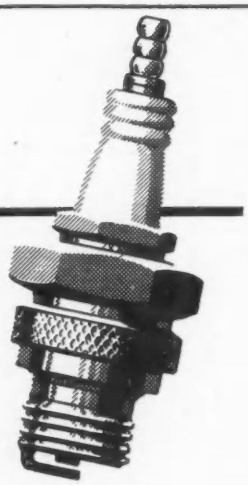
At the present writing the suspended assembly conveyor is quite simple in pattern. For most of its length it is in a straight line parallel with the main aisle of the building. The initial stations, beginning with the frame fixture, are at right angles to the straight section. At the first station the chassis is fitted in a carrier and lifted out of the fixture by means of an elevator above the fixture. The carrier is pushed forward for a short distance by the operator until it meets the power drive conveyor which engages the carrier and moves the work under power from that point on. Engagement with the power drive and dis-engagement for power-free travel at several points is completely automatic.

With this arrangement the chassis travels top-side-up at all times. Rear springs are mounted in this position and the rear axle and torque tube assembly is snaked in over the springs at a succeeding station. Brake bleeding takes place just past the bend into the main aisle and engines are installed immediately thereafter. The sequence of operations is quite conventional along the line and just before the wheel conveyor is reached the chassis is ready for paint spray. This is done in the usual double-booth manner, except that Chevrolet now has one of the few lines in which the chassis moves through the spray booth while suspended from a monorail.

Following wheel mounting, the chassis reaches the end of the monorail section and is ready for the final assembly starting with the body drop while moving on a floor conveyor on its wheels. At this point the power line automatically disengages the carrier and moves away from the conveyor

(*Turn to page* 86, *please*)

6 out of 9*



leading makers of spark plugs use OAKITE CLEANING MATERIALS

** rated AAAA in Thomas' Register*

CONVINCING proof, we think, to show that critical cleaning goes hand in hand with profitable precision production. Reason enough why leading spark plug manufacturers insist on Oakite materials and methods for cleaning before and after heat treatment; pickling; rust-proofing and related operations for production-cleaning of spark plug components.

How YOU Can Profit

No matter what product you produce, it'll pay you to investigate Oakite materials for your descaling, degreasing, surface conditioning, paint-stripping and related procedures. These Oakite compounds include alkaline, solvent and acidic type materials designed to give you more cleaning work in less time for less money—savings sure to justify plant-wide standardization of Oakite cleaning materials and techniques.

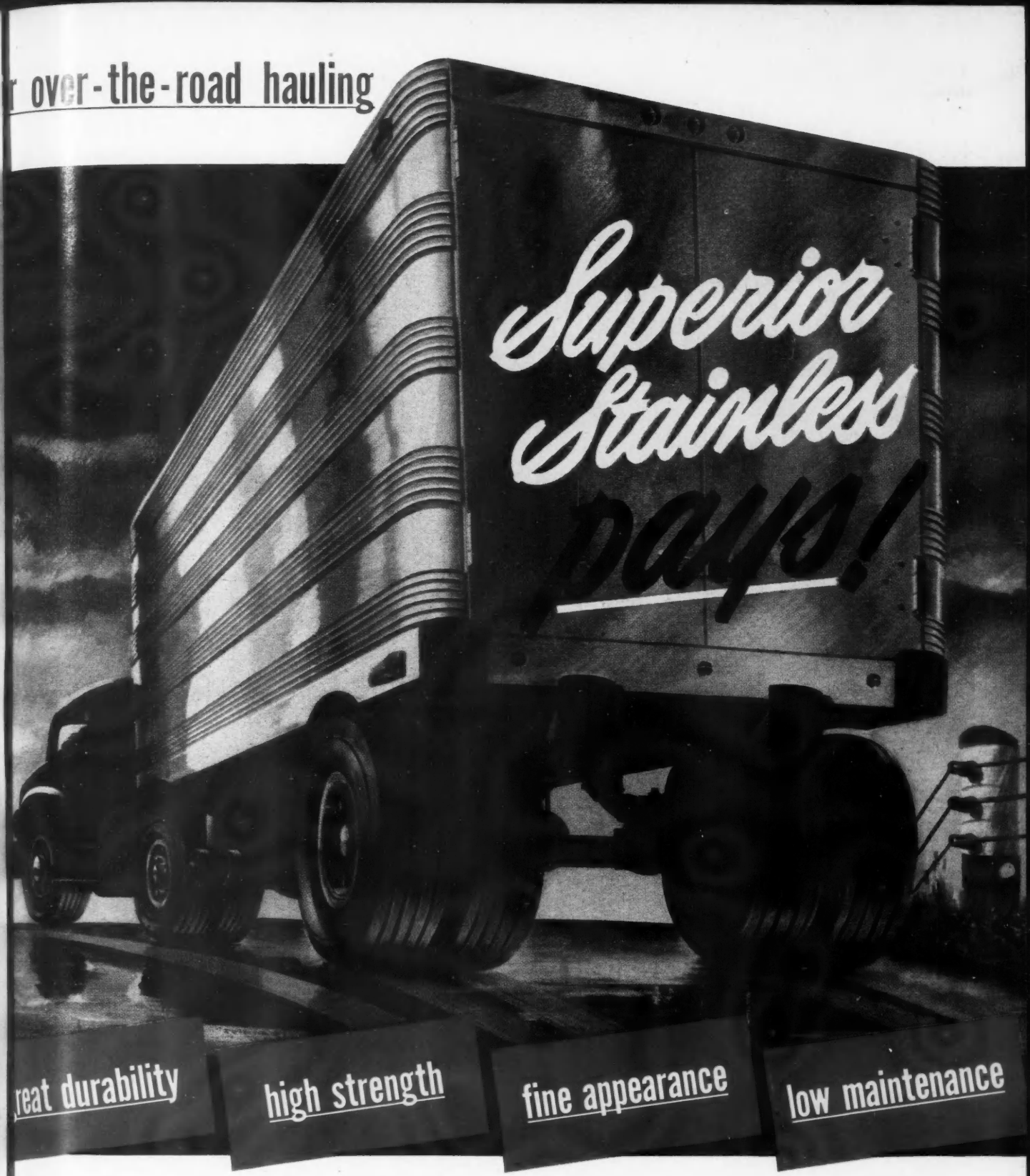
You can make those savings yours merely by asking your Oakite Technical Service Representative to review your cleaning cycles . . . suggest Oakite solutions sure to meet your most exacting requirements. Write to Oakite Products, Inc., 28A Thames St., New York 6, N. Y.

OAKITE

REG. U. S. PAT. OFF.

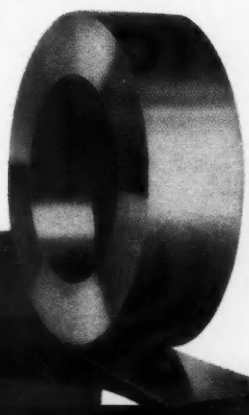
SPECIALIZED CLEANING MATERIALS • METHODS • SERVICE

Technical Representatives in Principal Cities of U. S. & Canada



Stainless steel is the top metal for modern body builders. Stainless is strong, tough and durable, affords better protection for the load and lower maintenance cost. Stainless is bright and stays bright.

SUPERIOR high tensile stainless strip steel provides the greatest strength with the lightest weight. Use SUPERIOR Stainless for *more pay load on the road.*



Superior Steel

Superior
Stainless strip steel

PERMANENT RESILIENCE

Resilient parts made from HYCAR synthetic rubber *stay* resilient. That's partly because of HYCAR's unusual chemical stability—its resistance to oil and gas, acids and most other chemicals. And parts made from HYCAR are extremely resistant to the effects of oxidation, sunlight, and normal aging. A HYCAR sealing ring, for example, will maintain a positive seal through years of service even when constantly exposed to oils and acids inside the pipe, and sunlight and salt air outside.

Other unusual and valuable properties are listed in the box at the right. But most important, these properties may be had in an almost limitless number of combinations, each designed to meet the specific service conditions of the finished part. Parts made from HYCAR have seen service in *every* industry, giving long life, dependability, and economical operation.

That's why we say ask your supplier for parts made from HYCAR. Test them in your own applications, difficult or routine. You'll learn for yourself that it's wise to use HYCAR for long-time, dependable performance. For more information, please write Dept. HD-8, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

CHECK THESE SUPERIOR FEATURES OF HYCAR

1. *EXTREME OIL RESISTANCE — insuring dimensional stability of parts.*
2. *HIGH TEMPERATURE RESISTANCE—up to 250° F. dry heat; up to 300° F. hot oil.*
3. *ABRASION RESISTANCE—50% greater than natural rubber.*
4. *MINIMUM COLD FLOW—even at elevated temperatures.*
5. *LOW TEMPERATURE FLEXIBILITY — down to —65° F.*
6. *LIGHT WEIGHT—15% to 25% lighter than many other synthetic rubbers.*
7. *AGE RESISTANCE—exceptionally resistant to checking or cracking from oxidation.*
8. *HARDNESS RANGE—compounds can be varied from extremely soft to bone hard.*
9. *NON-ADHERENT TO METAL—compounds will not adhere to metals even after prolonged contact under pressure. (Metal adhesions can be readily obtained when desired.)*

Hycar

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American Rubber

B. F. Goodrich Chemical Company

A DIVISION OF THE B. F. GOODRICH COMPANY

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE INDUSTRIES

Renewed advances in general business activity are indicated. The *New York Times* index for the week ended July 19 stands at 141.5, as against 130.5 for the preceding week and 136.4 a year ago.

Sales of department stores during the week ended July 26, as reported by the Federal Reserve Board, equaled 218 per cent. of the 1935-39 average, as compared with 217 per cent. in the week before. Sales were 4 per cent. above the corresponding distribution a year earlier, as against a preceding similar excess of 8 per cent. The total in 1947 so far reported is 10 per cent. greater than the comparable sum in 1946.

Electric power production increased slightly in the week ended July 26. The output was 8.7 per cent. above the corresponding amount in 1946, as compared with a like advance of 10.2 per cent. shown for the preceding week.

Railway freight loadings during the same period totaled 919,928 cars, .02 per cent. more than the figure for the week before and 1.0 per cent. above the corresponding number recorded last year.

Crude oil production in the week ended July 26 averaged 5,083,650 barrels daily, or 33,800 barrels more than the preceding average and 157,600 barrels above the comparable output in 1946.

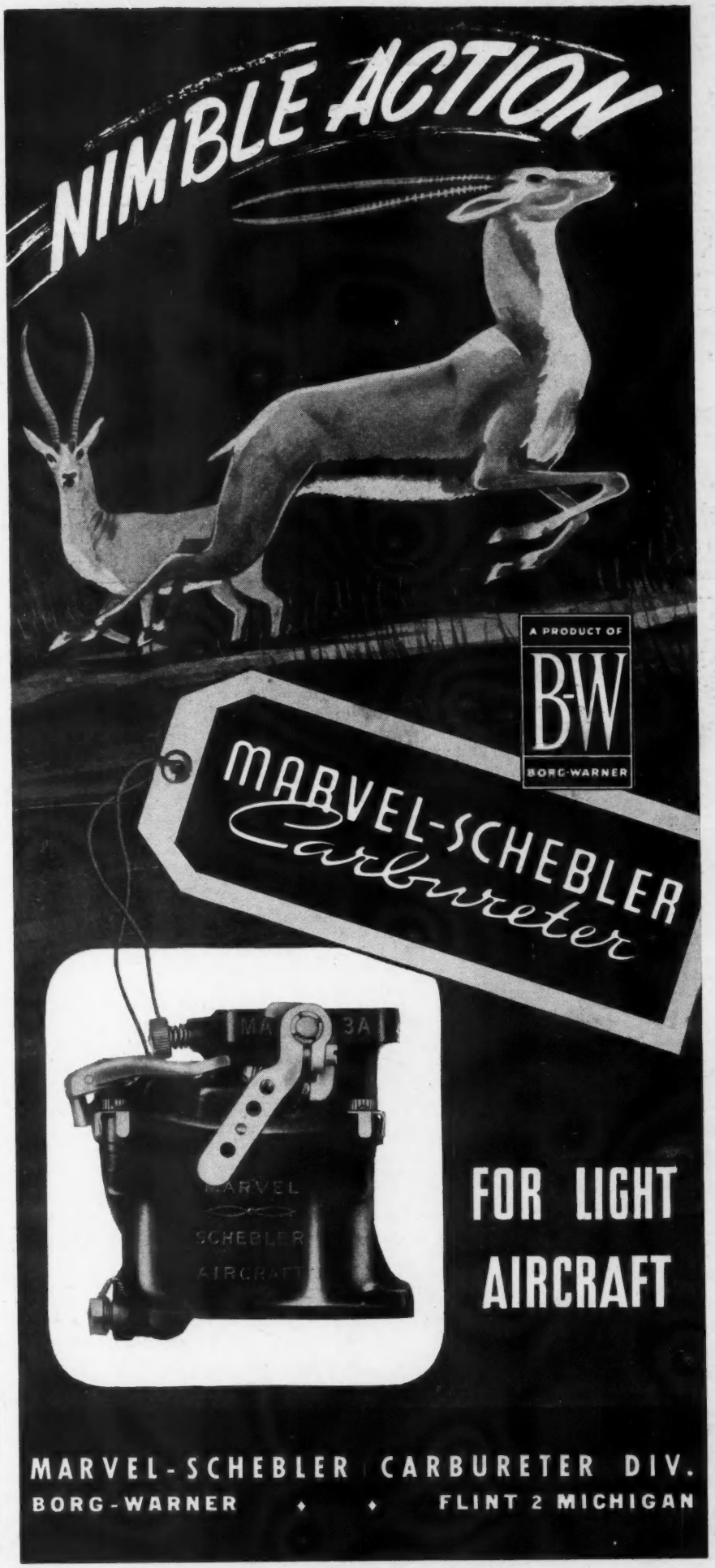
Production of bituminous coal and lignite during the week ended July 26 is estimated at 11,800,000 net tons, 2.3 per cent. less than the output in the week before. The total production in 1947 so far reported is 22.5 per cent. above the corresponding quantity in 1946.

Civil engineering construction volume reported for the week ended July 31, according to *Engineering News-Record*, is $100,834,000, or 25 per cent. less than the preceding weekly figure and 13 per cent. below the comparable sum in 1946. The total recorded for thirty-one weeks of this year is 2 per cent. less than the corresponding amount in 1946. Private construction is 9 per cent. below that a year ago, but public construction has increased by 9 per cent.

The wholesale price index of the Bureau of Labor Statistics for the week ended July 26 is 150.6 per cent. of the 1926 average, as compared with 150.3 for the preceding week and 124.1 a year ago.

Member bank reserve balances increased $110,000,000 during the week ended July 30. Underlying changes thus reflected include an advance of $217,000,000 in Reserve bank credit and a decrease of $234,000,000 in Treasury deposits with Federal Reserve banks, accompanied by a decline of $16,000,000 in money in circulation.

Total loans and investments of reporting member banks increased $97,000,000 during the week ended July 23. An increase of $35,000,000 in commercial, industrial and agricultural loans was recorded. The sum of these business loans, $11,883,000,000, shows a net increase of $3,017,000,000 in twelve months.



Chevrolet's New Flint Plant

(*Continued from page* 82)

line leaving the carrier free. There are two floor assembly lines at this point and it is the job of the dispatcher to select the line to which any given chassis is routed. The chassis is then pushed into an elevator station at the head of either line, the function being to lower the chassis onto the floor, release the carrier, and then lift the carrier to a higher level where it is picked up by the power chain and returned to the elevator at the frame assembly station at the head of the line.

All major sheet metal parts as well as the body are given a Bonderite treatment before painting to assure resistance to corrosion. In addition, Chevrolet has installed a small parts washing machine for Granodizing all small parts — brackets, fittings, fastenings, etc. Thus the corrosion treatment usually reserved for the major parts has been extended to all minor parts and bolts and nuts as well.

Space does not permit more than passing reference to the polishing and finishing of sheet metal parts, painting of wheels, preparation of bodies for the line, and a variety of other important operations. Suffice it to say that although this plant does no manufacturing in the sense of machine shop or press work, it is packed with many processes usually associated with a full-scale manufacturing operation.

Front end sheet metal — fenders, grille, and other detail parts—as well as installation of the radiator core, is made up as a unit assembly in special fixtures. The radiator core is installed in another fixture following initial sheet metal assembly.

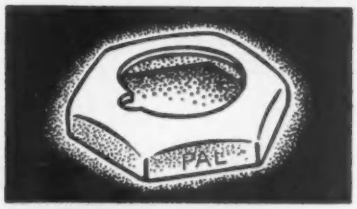
Reference should be made to the truck department, a self-contained unit. While the truck assembly lines are quite conventional, the cab and panel body assembly and paint lines are exceptional. All of the paint line operations are handled on an overhead conveyor system composed of seven different conveyors. The paint shop includes four ovens, ten spray booths.

Because of the difference in the length of the cabs and bodies handled here, there are three different types of carriers on the monorail. As the bodies enter the spray booths they move power-free by an automatic disconnect from the monorail. They are easily pushed through by the operators since the rail in the booth is given a downgrade pitch. Upon emerging from the spray booth the body is again power conveyed. Movement into baking ovens is automatic and includes automatic opening and closing of oven doors. For this purpose the carrier, depending upon the type of body it handles, has a selector switch operating bar which determines the opening of the door in advance of body entry and closing after the body has entered the oven.

Scheduling of passenger car and truck assembly and preparation of subassemblies is done by means of a comprehensive telautograph system. The master station for passenger car line scheduling is located at the body bank —at the point where Fisher Body delivers bodies to Chevrolet. Teleautograph receiving stations are located at nine key points throughout the plant.

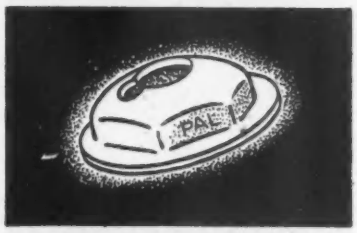
The truck department has its own master station and eight sub-stations to control the scheduling of parts, bodies, and final assembly lines.

PALNUT SELF-LOCKING NUTS
For speedy low-cost assembly



Inverted PALNUTS

For moulding strips, medallions, tail and parking lights, radiator grilles, etc. Replaces regular nut and lock-washer.



Washer PALNUTS

For above applications where washer type base is desirable. One Washer "Palnut" replaces regular nut, lock-washer and plain washer.

Acorn PALNUTS

Pleasing dome shape covers bolt ends, improves appearance, protects car owners from injury. Used on glove compartments, rear decks and license brackets. Self-locking, replaces regular cap nut and lockwasher.

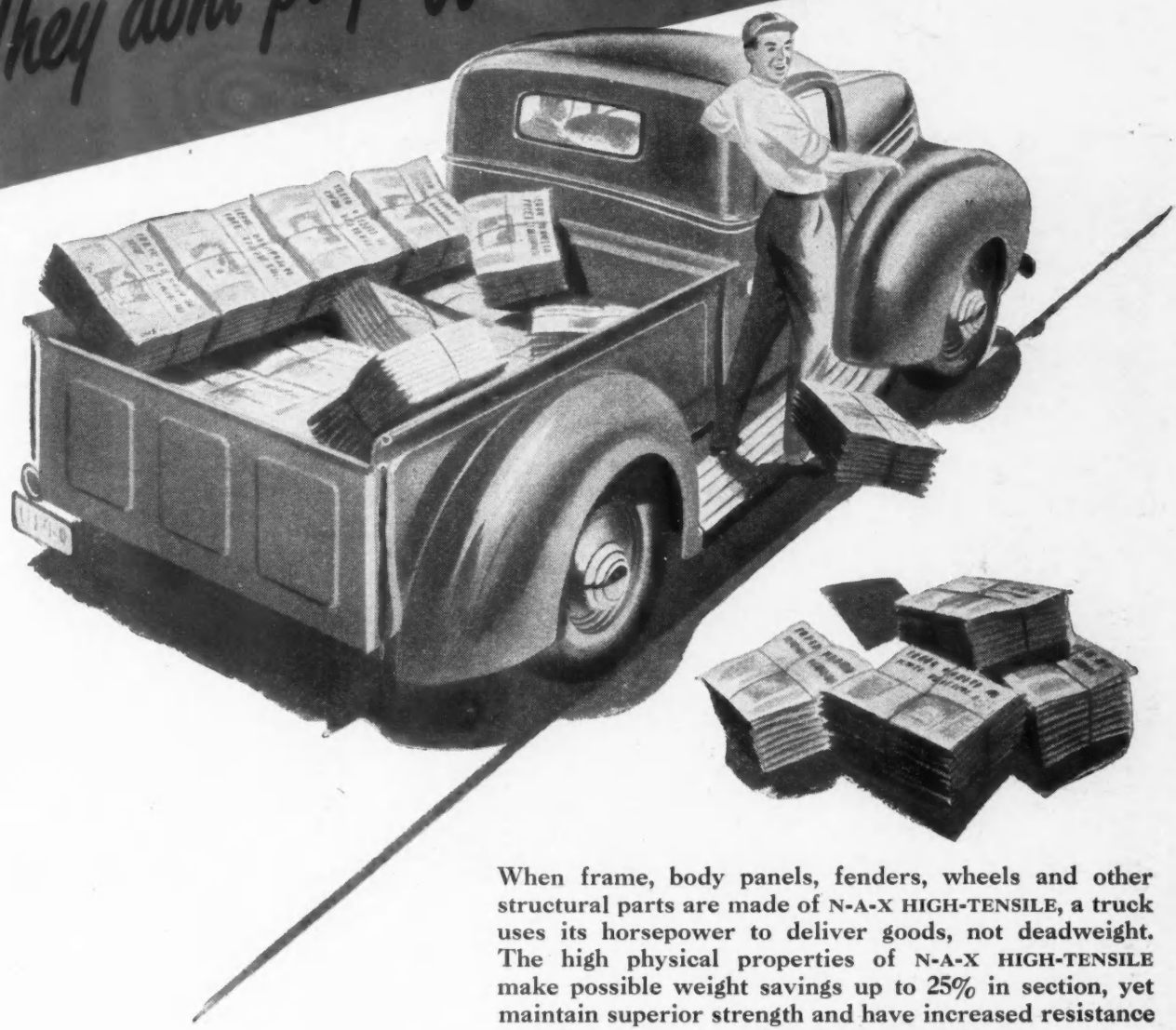
All "Palnuts" are readily adaptable to power tool assembly, further speeding up fastening and cutting costs.

Send details of assembly for samples and data

THE PALNUT COMPANY, 60 Cordier St., Irvington 11, N. J.
Detroit Office: 3-213 General Motors Building

PALNUT SELF-LOCKING NUTS

They dont pay off on DEADWEIGHT



When frame, body panels, fenders, wheels and other structural parts are made of N-A-X HIGH-TENSILE, a truck uses its horsepower to deliver goods, not deadweight. The high physical properties of N-A-X HIGH-TENSILE make possible weight savings up to 25% in section, yet maintain superior strength and have increased resistance to fatigue, corrosion, abrasion and denting.

On the job, the savings in pounds mean a savings in dollars. Gasoline economy is improved. Maintenance costs are reduced. Life factor is increased.

If you make a product that moves, it will move more efficiently and economically through the application of N-A-X HIGH-TENSILE. Good formability, excellent weldability and fine surface texture for finishing make N-A-X HIGH-TENSILE a great steel to work with, too.

MAKE A TON OF SHEET STEEL GO FARTHER

Specify—

N·A·X

HIGH-TENSILE STEEL

GREAT LAKES STEEL CORPORATION

N-A-X ALLOY DIVISION • DETROIT 18, MICHIGAN

UNIT OF NATIONAL STEEL CORPORATION

Aircooled Motors Gets $1 Million Order From AAF

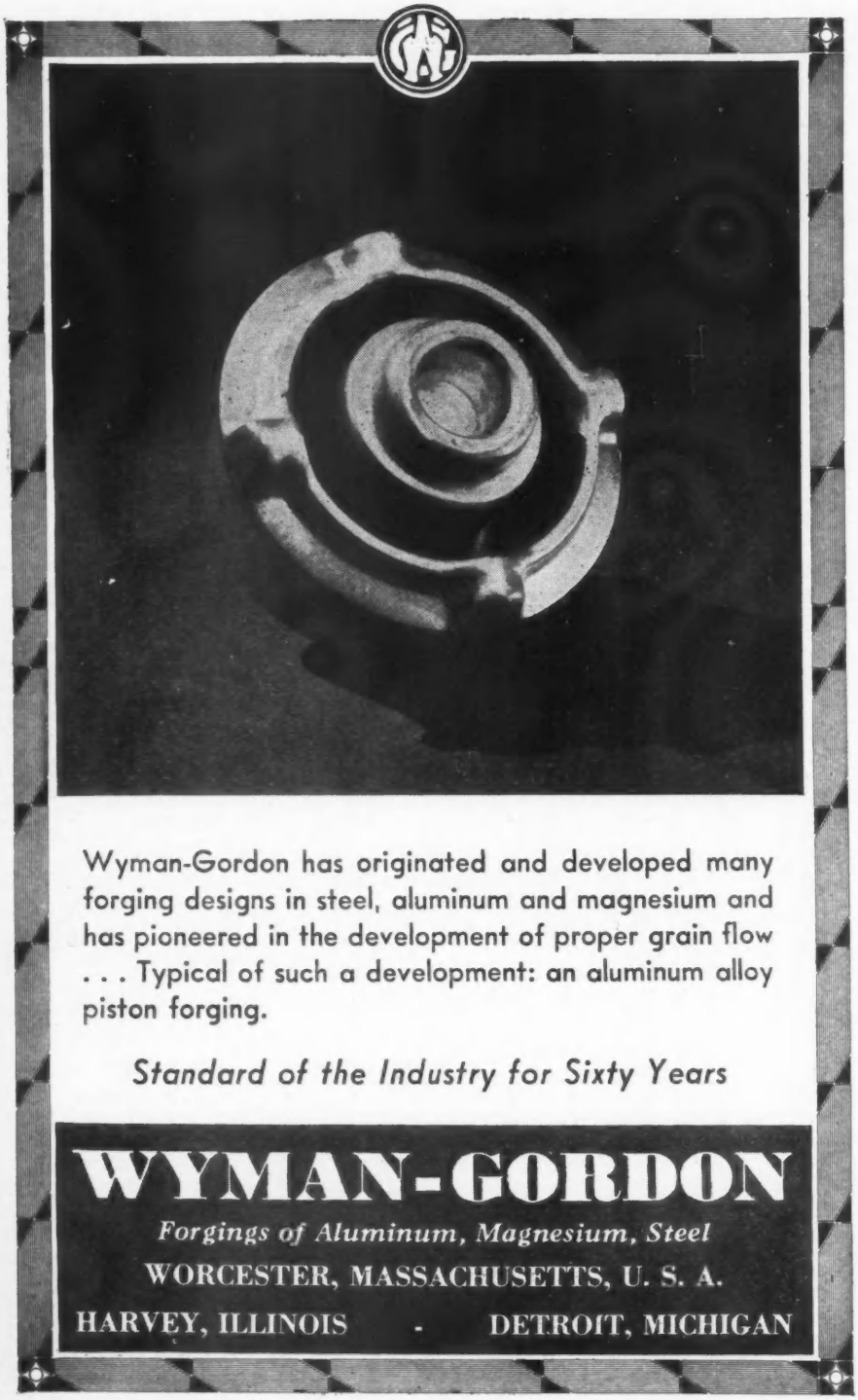
A contract for the production of engines, parts, tools and fixtures for the Army Air Forces amounting to more than $1 million has been obtained by Aircooled Motors, Inc., Syracuse, N. Y.

R. R. Rausch on GE Staff As Manufacturing Adviser

Raymond R. Rausch, formerly an executive and director of the Ford Motor Co., has joined the staff of C. E. Wilson, president of General Electric Co., as engineering consultant. His headquarters will be in Chicago.

Auto-Lite Expands

The Wire and Cable Div. of the Electric Auto-Lite Co. in Port Huron, Mich., will soon have additional facilities in operation. It is expected that these will permit a 25 per cent increase in output. Auto-Lite expects to have a new battery plant in Vincennes, Ind., in production by September, as well as another battery plant in Owosso, Mich.


Wyman-Gordon has originated and developed many forging designs in steel, aluminum and magnesium and has pioneered in the development of proper grain flow . . . Typical of such a development: an aluminum alloy piston forging.
Standard of the Industry for Sixty Years
WYMAN-GORDON
Forgings of Aluminum, Magnesium, Steel
WORCESTER, MASSACHUSETTS, U. S. A.
HARVEY, ILLINOIS - DETROIT, MICHIGAN

Crisis In Czechoslovakia

(*Continued from page* 29)

as possible, this need will be filled through compensation deals with Italian factories Alfa Romeo and Fiat.

There are many complaints as regards the high prices of fuel and tires. The latter costs five times more than before the war; there is also a plan to introduce a tire duty, so that increased difficulties are to be reckoned with. A set of four tires for a medium size vehicle would cost in the neighborhood of 5000 Kc (about $100).

Following are data on the new Czechoslovakian automobiles.

PASSENGER VEHICLES — Jawa Minor II: Two-cylinder, two-stroke, air-cooled engine; 42.7 cu in. piston displacement. Overall length, width and height, 173 in., 55 in. and 57 in. respectively. Weight 1500 lb. Maximum speed 50 mph. Twenty-nine miles per gal of fuel. Skoda 1101: Four-cylinder, four-cycle, water-cooled engine; 67 cu in. piston displacement. Overall length, width and height, 159 in., 59 in., and 59.5 in. respectively. Total weight 1950 lb. Maximum speed 56 mph. Twenty-three miles per gal fuel. Tatra 107 (coming out the second half of this year) is to be an air-cooled, four-cylinder rear-engine vehicle. Piston displacement 122 cu in. Total weight 2420 lb. Maximum speed 68 mph. Eighteen miles per gal of fuel.

TRUCKS—Skoda 1.5 ton: Four-cylinder gasoline engine, 128 cu in. piston displacement, 70 bhp. Maximum speed 50 mph. Ten miles per gal of fuel. Praga three ton: Four-cylinder Diesel engine, 27.4 cu in. piston displacement. Maximum speed 31 mph. Fourteen miles per gal Diesel fuel. Skoda seven ton: Six-cylinder Diesel engine, 670 cu in. piston displacement, 145 bhp. Maximum speed 37 mph. Ten miles per gal Diesel fuel. Tatra nine ton: 12-cylinder air-cooled Diesel engine, 88.5 cu in. piston displacement, 160 bhp. Maximum speed 40 mph. Eight miles per gal Diesel fuel.

Britain's Trade Show

(*Continued from page* 47)

in the ship for the purpose. Working demonstrations of much of the machinery included in the exhibition were given.

The trade show was reported to have been exceptionally well received at all ports, the best sellers being the Pony truck, nail making and wire forming machines, oil boring equipment and baking machinery.

All exhibits, with the exception of showcases, photographic displays and models have been sold to various agents in South America, and were taken off at Buenos Aires for forwarding to their several destinations.

The ability of Foote Bros. to produce the unusual in gears is well known—giants 20 feet in diameter to drive cement kilns or sugar mills—A-Q (aircraft quality) gears of a precision that almost reaches theoretical perfection.

Because of this, many companies overlook the fact that the bulk of Foote Bros.' gear production is in a wide variety of spur, helical, worm and bevel gears. These gears are today serving industry in the production of machine tools, road building machinery, mining machinery, diesel and gasoline engines, tractor transmissions and an extensive list of other types of equipment.

In the two large plants of Foote Bros. you will find everything necessary to produce quality gears of any size and in any quantity—an engineering staff thoroughly experienced in every phase of gear production—the latest in modern high speed machinery—an extensive heat-treating department with controlled atmosphere furnaces, quenching presses, carburizing and nitriding furnaces, and above all a background of nearly a century of experience in meeting and solving the toughest gear problems. We welcome the opportunity of discussing your gear requirements with you.

FOOTE BROS. GEAR AND MACHINE CORPORATION
Dept. F, 4545 S. Western Blvd. Chicago 9, Ill.

FOOTE BROS.
Better Power Transmission Through Better Gears

Three bulletins on Foote Bros. products are available. Check the coupon for the ones you are interested in.

☐ FOLDER "WHATEVER YOUR NEEDS IN GEARS"
☐ BULLETIN "AIRCRAFT QUALITY GEARS"
☐ BULLETIN "FOOTE BROS. POWER UNITS"

Name.....

Address.....

City.....*State*.....

General News

(*Continued from page* 23)

from Korea. Lead scrap amounting to 945 tons from Japan will be sold by the U. S. Commercial Co., RFC subsidiary. The lead is to be sold on a sealed bid basis, for delivery f.o.b. Staten Island, N. Y. in nine lots of about 105 tons each.

Bronze

Price increases for brass and bronze ingots have been announced by major producers. Increased foundry buying as vacation periods end, and copper and brass scrap price rises are responsible for the increases. The increases amount to about a cent a pound in most grades, and in some grades only ¾¢.

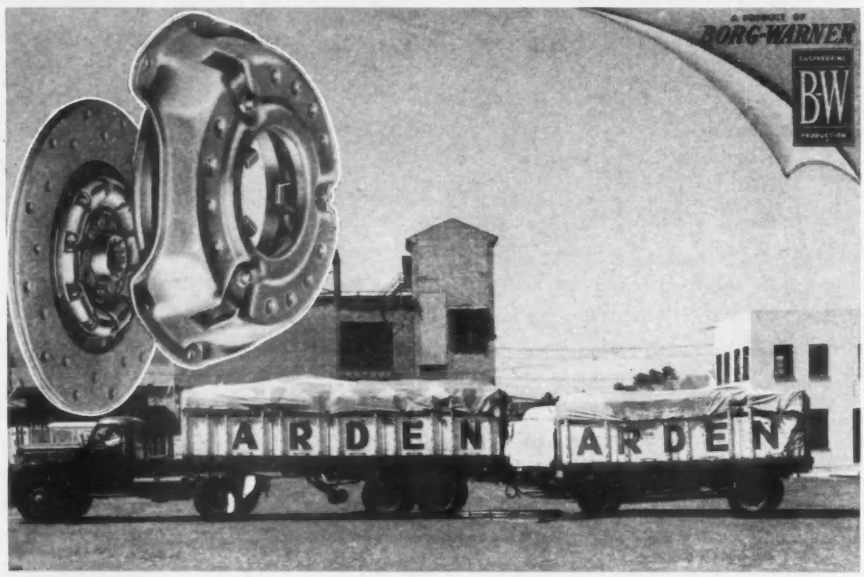
K-F Buys Steel Mill

The Chapman-Price Steel Co., Indianapolis, a subsidiary of Continental Steel Corp., Kokomo, Ind., has been bought by the Kaiser-Frazer Corp. With a capacity of 55,000 tons annually, property and management of the steel rolling mill will be taken over by K-F on Oct. 1, further strengthening Kaiser-Frazer's basic material supply.

Crosley Engine Powers Mooney Plane

A Crosley automobile engine is being used to power the single seater Mooney M-18, flight tested recently by the Mooney Aircraft Co., Wichita. The plane reportedly cruises at 90 mph, with a rate of climb of 500 fpm. The engine is rated at 25 hp., but President A. Mooney expects to get between 28 and 30 hp, in a production plane.

ROCKFORD



SPRING – LOADED CLUTCHES

LIGHT PEDAL PRESSURE
CUSHIONED ENGAGEMENT
VIBRATION DAMPENING
ACCURATE BALANCE
DIRT EXCLUSION
HEAT DISSIPATION
LIFETIME ADJUSTMENT

* Over a quarter of a century of experience designing many types of clutches, for use in a wide variety of industries, has proved to ROCKFORD engineers the importance of liberating the heat that is generated within friction type clutches. For this reason, ROCKFORD CLUTCHES cover designs provide for ample ventilation. Other parts that help dissipate heat are designed accordingly.

Send for This Handy Bulletin

* Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

ROCKFORD CLUTCH DIVISION BORG-WARNER
315 Catherine Street, Rockford, Illinois, U.S.A.

IFMA Prize Contest For Trade Press Articles

The Industrial Furnace Manufacturers Association, Inc. has announced the "IFMA Prize Contest" to promote the publication of articles in the trade press describing the economic advantages to be obtained by the use of modern industrial furnaces, kilns, and ovens. The first prize is $1000; the second, $300; and the third, $200. Articles published between October 1, 1947, and Septem-

(*Turn to page* 92, *please*)

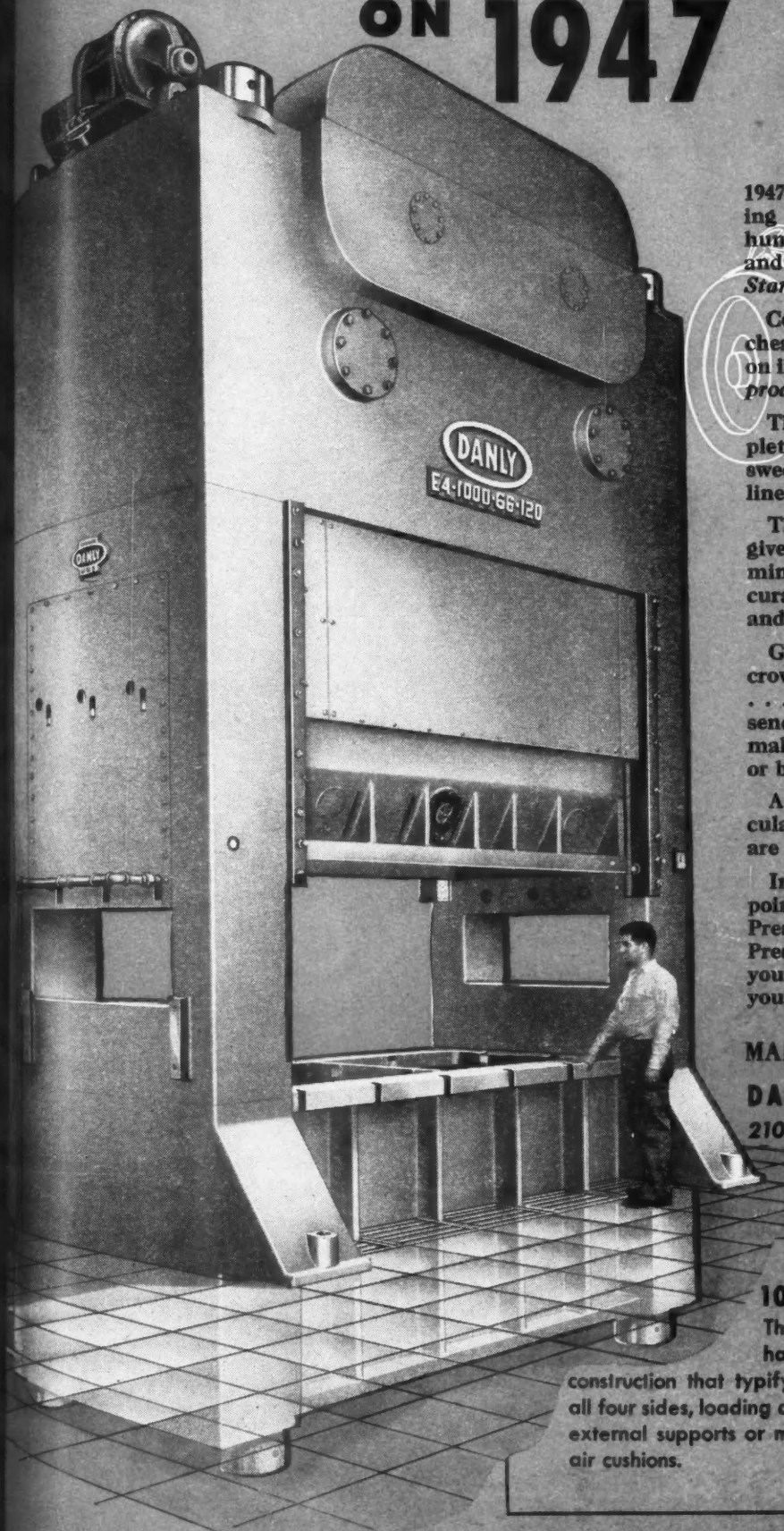
CALENDAR

Conventions and Meetings

Soc. of Automotive Engineers—West Coast Transportation & Maintenance Mtg., Los Angeles....Aug. 21-23
Natl. Air Races, Cleveland..Aug. 30-Sept. 1
Amer. Soc. of Mechanical Engineers—Fall Mtg., Salt Lake City.....Sept. 1-4
Amer. Soc. of Mechanical Engineers—Ind. Instrument & Regulators Div., Chicago .....Sept. 8-9
Instrument Society of America Conference, Chicago .....Sept. 8-12
Society of Automotive Engineers—Tractor Mtg., Milwaukee....Sept. 17-18
Natl. Machine Tool Builders Assoc. Machine Tool Show, Chicago, Sept. 17-26
Soc. Automotive Engineers, Aeronautic Mtg., Los Angeles .....Oct. 2-4
Amer. Soc. of Mechanical Engineers, Petroleum Mech. Eng. Conf., Houston, Tex. .....Oct. 6-8
Natl. Conference of Industrial Hydraulics, Chicago .....Oct. 16-17
Soc. of Automotive Engineers, Production, Cleveland .....Oct. 20-21
Amer. Soc. Tool Engineers—Semi-Annual Mtg., Boston.....Oct. 30-Nov. 1
Natl. Electrical Mfrs. Assoc., International Lighting Exposition & Conference, Chicago .....Nov. 3-7
Amer. Society of Body Engineers, Annual Tech. Convention, Detroit, Nov. 5-7
Society of Automotive Engineers, Fuels & Lubricants Mtg., Tulsa.....Nov. 6-7
Society of Automotive Engineers-Air Transport Mtg., Kansas City..Dec. 1-3
Amer. Soc. of Mechanical Engineers, Annual Mtg., Atlantic City....Dec. 1-5
Automotive Service Industries Show, Chicago .....Dec. 8-13
Soc. of Automotive Engineers Annual Mtg., Detroit .....Jan. 12-16

MAKE 1947 PRODUCTS

ON 1947 PRESSES



1947 Product manufacture—of automobiles, washing machines, refrigerators, electric ironers—hundreds of other items for the home, shop, store and office—has become, in the main, *a matter of Stamping or Press Production.*

Consequently, the problem of greater and cheaper production of these items depends largely on improving techniques and facilities for *greater production with presses.*

The Danly Press has been designed for complete utility—designed to keep pace with the sweep of progress demonstrated in the streamlined products of 1947.

The machine tool accuracy of Danly Presses gives smoother performance, quiet operation and minimum wear—makes for faster runs, more accurate stampings, longer die life, less downtime and *greater production.*

Gears and driving members built within the crown keep out dust and other foreign material . . . Modern enclosed construction and the absence of outboard machinery promote safety, make for a neat appearance—especially in rows or batteries.

A rugged Danly Air-Friction Clutch and a Circulatory pump driven oil spray lubrication system are featured in the Danly Press.

Investigate Danly's complete line of 1, 2 and 4 point single, and double action Straight-Side Presses, and Horning, Inclinable and Gap-Frame Presses. They will put the same efficiency into your *production facilities* that you have put into your *product.*

MAKE 1947 PRODUCTS ON 1947 PRESSES

DANLY MACHINE SPECIALTIES, INC.

2100 South 52nd Avenue • Chicago 50, Illinois

1000-TON STRAIGHT-SIDE PRESS

This precision built 4-point Single Action Press has the clean lines, the completely enclosed construction that typify the Danly line. Readily accessible from all four sides, loading and unloading this press is not hampered by external supports or machinery. The bed is machined to receive air cushions.

DANLY . . THE PRESS FOR MODERN PRODUCTION

General News

(*Continued from page* 90)

ber 30, 1948, will be eligible. All individuals and groups may compete, with the exception of those connected with the industrial furnace, kiln, or oven industry. Rules and other details may be obtained from the IFMA, 420 Lexington Av., N. Y. C.

Gaybex in New Quarters

The Gaybex Corp., Newark, N. J., recently acquired new facilities covering about 25,000 sq ft of industrial manufacturing space at 70 Lister Av., Newark, nearly 20 times larger than their pilot plant in Delawanna, N. J., it was recently announced by John B. Moore, president of Gaybex. Gaybex makes cleaning and degreasing compounds and penetrants, its first product was G-BEX 45A, a concentrated degreasing compound; later products developed were the G-SOL, two high flash point liquid solvents for single phase parts cleaning; and G-SOL 195 for the cleaning of electric motors. Recently developed was G-PEN TR for tire maintenance, permitting easy removal of the casing from the rim. John Coudert, formerly sales manager of Daintee Products Co., and an officer of Vetex Products Co. is in charge of Gaybex's Automotive Sales Div., and Mill and Contract Sales are handled by John B. Moore.

The "624" is flexibly designed so that it can be heated by steam, gas or electricity. Only eight square feet of floor space is required.

IN A **BIG** WAY

That's the Detrex "624"—SMALL, in the floor space it occupies; BIG, in the degreasing job it does.

The "624" fits small shop layouts where floor space is limited and where parts cleaning must keep ahead of production. One of its favorite applications is in garages for the removal of grease, dirt, caked-on road soils encountered in servicing and repairing engine parts.

Yes, standard "624's" are kept in stock for immediate delivery. Call the Detrex field representative nearest you today.

DETREX Corporation
DETROIT 32, MICHIGAN
E-170

Buick Raises Price Of Station Wagons

General Motors Corp.'s Buick Motor Div. has increased the list price of Buick station wagons $100. The price of the Series 50 estate wagon is now $2522 and the series 70 estate wagon is now $2970. The sharp rise in the price of materials purchased for the bodies, and relatively low volume production were responsible for the increase.

Tinnerman Sponsors $5500 Kingcobra Race

Tinnerman Products, Inc., Cleveland, is sponsoring the $5500 race for Bell P-63 (Kingcobra) fighter type planes to be flown at the National Air Races on September 1. The event will be known as the Tinnerman Trophy Race.

B. F. Goodrich Makes Wire-Cord Truck Tires

Truck tires using wire-cord are being produced by the B. F. Goodrich Co., according to J. E. Gulick, general manager of the Tire Manufacturing Div. Under equal service conditions, the wire-cord tires, with fewer plies, run cooler than cord fabric tires of the same size.

Chevrolet Price Up For Special Models

Low volume production and the recent cost increase in parts furnished by outside suppliers, recently forced about a $100 advance in the price of Chevrolet station wagons, and a rise of approximately $75 in the price of Chevrolet convertibles.

Convert Test Station for Synthetic Fuel Production

After more than a year's delay, during which plant facilities were turned to emergency production of ammonia for fertilizers, the Bureau of Mines has again taken over the Missouri Ordnance Works at Louisiana, Mo., and resumed its work of converting the plant from production of synthetic ammonia to synthetic liquid fuels. The return transfer of engineering personnel has been completed and the go ahead signal has been given for the $6.8 million engi-

(*Turn to page* 94, *please*)

NEW! Wilco Ni-Span C*

CONSTANT MODULUS ALLOY

NI-SPAN C is a Titanium-Chromium-Nickel-Iron alloy with the outstanding property of having a constant modulus, i. e. a zero thermoelastic coefficient, over a range of temperature from—50 to + 150°F. Most metals have a negative thermoelastic coeffcient, that is they become elastically weaker or decrease in stiffness with rise in temperature. The important difference between Ni-Span C and other materials, whether of the constant modulus type or otherwise, lies in the fact that Ni-Span C is a precipitation hardening alloy in which the thermoelastic coefficient is adjustable through age hardening heat treatment. This unique combination of modulus control plus the high elastic and strength properties obtained through age hardening makes Ni-Span C a new material having very important commercial applications, the most important being those where constant elastic characteristics are required without the necessity of temperature compensating devices.

Advantages of NI-SPAN C:

1. Higher hardness and higher mechanical properties obtainable through a precipitation hardening heat treatment, than can be obtained with other constant modulus alloys through cold working.

2. An extremely important advantage of Ni-Span C is that the precipitation hardening heat treatment which brings about the marked improvement in physical properties can also be utilized to adjust the thermoelastic coefficient of a given Ni-Span C composition within a certain range by means of appropriate variation in this heat treatment.

Applications:

Watch and instrument hair springs, accurate weighing scale springs, and accurate springs of all kinds, where inherent temperature compensation is required. Diaphragms for pressure sensitive instruments. All types of parts in which extremely low creep or hysteresis values are required. While the controllable modulus property does not hold good beyond 150°F., Ni-Span C has shown very small relaxation in long time tests up to 550°F.

NOW READY! Comprehensive Wilco Data Bulletin on NI-SPAN C, including complete physical and mechanical properties, recommended times for heat treatment and other pertinent information. Send for *your* copy.

Whatever your requirements for Wilco materials, our engineers will gladly help you meet them successfully.

WILCO PRODUCTS INCLUDE: THERMOSTATIC BIMETAL—Wide temperature ranges, deflection rates and electrical resistivities. CONTACTS—Silver-Platinum-Tungsten-Alloys-Sintered Powder Metal. SILVER CLAD STEEL. JACKETED WIRE—Silver on Steel, Copper, Invar or other combinations requested. ROLLED GOLD PLATE AND WIRE NI-SPAN C New Constant Modulus Alloy. SPECIAL MATERIALS.

*Reg. Trade Mark The International Nickel Co., Inc.

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SPECIALISTS FOR 30 YEARS IN THE MANUFACTURE OF THERMOMETALS · ELECTRICAL CONTACTS · PRECIOUS METAL BIMETALLIC PRODUCTS

ADEL

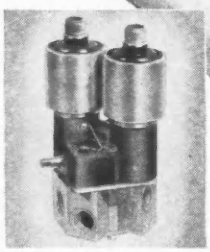
Precision Hydraulic Equipment

The story of experience, gained through the war years, has been told many, many times. But the manufacturer who today goes on to design better equipment and develop specific applications, is a little more rare. The success story of Adel is based on *precision* manufacture of Hydraulic Equipment. This policy of producing only the *best* in material and design is of tangible value to the Aircraft Industry today. For Adel provides a complete line of Precision Hydraulic Equipment for the planes now in production, and those being planned for tomorrow.

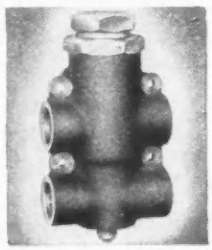
The ADEL Line of "3000 PSI" Precision Hydraulic Equipment

Shown here are a few "3000 PSI" items in Adel's broad line of Hydraulic Equipment. This equipment offers greater power with substantial savings in weight. Its simple design provides ready servicing and quick assembly. Constructed of the highest quality materials, all parts are precisely made and carefully inspected. Built for long life and *dependable operation.*

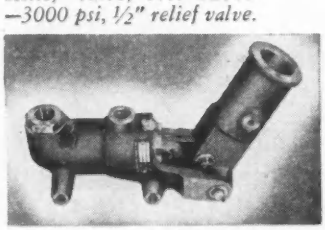
Adel Engineers are prepared to solve your specific application problems. Write today, for complete information on the Adel line of Precision Hydraulic Equipment for Aircraft.



Selector Valve, No. 16475—3000 psi, Solenoid-Operated with manual over-ride.



Relief Valve, No. 12108—3000 psi, ½" relief valve.



Hand Pump, No. 12044—3000 psi, double acting hand pump.

General catalog is available upon letterhead request. Please address inquiries to 10747 Van Owen Street, Burbank, California.

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BURBANK, CALIFORNIA ★ HUNTINGTON, WEST VIRGINIA

Manufacturers of: Aircraft Hydraulic Systems • Aircraft Valves • Line Supports Clips & Blocks • Halfco Self-Aligning Bearings • Marine & Industrial ISOdraulic Remote Controls • Industrial Hydraulic Equipment • Industrial Valves.

General News

(*Continued from page* 92)

neering and construction contract for conversion. Equipment, grading and housing contracts of $4 million have been placed. New structures will include coal and past preparation buildings, control houses, coal hydrogenation stalls, oxygen unit, and other facilities. Construction schedules call for the plant to be producing gasoline and oil from coal and lignite by next June. Centrally located with respect to major coal fields, the new synthetic demonstration plant will be utilized to test fuels from all fields to determine their suitability as a source of synthetic fuels. It will be operated in conjunction with the research and development laboratory at Bruceton, Pa., and is expected to serve as a proving ground for the processes sought for converting the nation's great coal reserves to liquid fuels.

Berry Develops Wheel Torque Device

Berry Motors Inc., Corinth, Miss., have revealed that they are ready to road test an automotive hydraulic pump with infinitely variable volume and pressure regulations, and a hydraulic motor to be placed in the wheel of an automobile and act with constant torque in both drive and braking. A vaneless rotary compressor on the same basic principle for compressed air brakes on automotive equipment is also being developed.

Obituary

Frank H. Russell

Frank H. Russell, 69, president of the Manufacturers Aircraft Association, Inc., for many years, died on Aug. 4, 1947, at his farm in Bucks County, Pa., after an illness of several months.

Crawford Neal Kirkpatrick

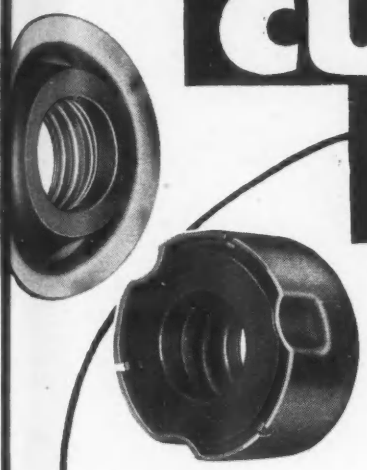
Crawford Neal Kirkpatrick, 57, Chairman of the Board of the Landis Machine Co., Inc., Waynesboro, Pa., died on July 28, 1947, at his home in Waynesboro after a recent illness.

Malcolm G. Campbell

Malcolm G. Campbell, 74, formerly president and chairman of the board of the Kelsey Wheel Co., Ltd. (Canada), died recently at his home in Windsor, Can., following a recent illness.

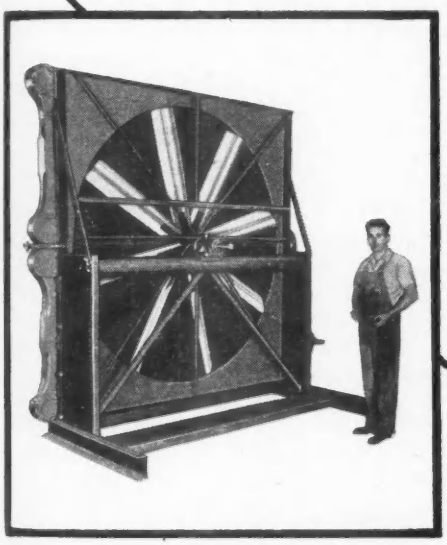
(*Turn to page* 96, *please*)

SCHWITZER-CUMMINS COMPANY... *Specialists*

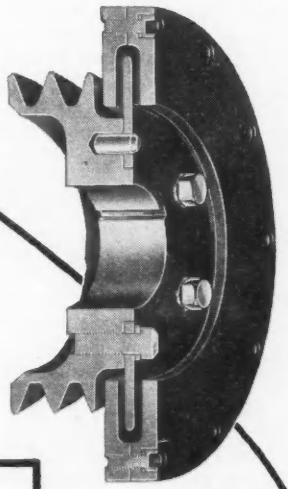


UNIT TYPE AUTOMATIC SHAFT SEALS

● For 30 years we have been supplying the country's fine engine builders with OIL PUMPS, WATER PUMPS, SUPERCHARGERS, COOLING FANS, AUTOMATIC SHAFT SEALS and TORSIONAL VIBRATION DAMPERS OF FRICTION AND FLEXIBLE RUBBER MOUNTED TYPES. The volume has been enormous and much of it has been the creation of our own engineering skill and laboratories. Such long and diversified service to the industry has built for us an unusual background from which to recommend what is best in design and application and then produce it. We solicit your inquiries in the belief that we can be of assistance in your engineering problems and save you money as well. WHATEVER THE APPLICATION, WE HAVE SOMETHING TO FIT YOUR NEEDS.

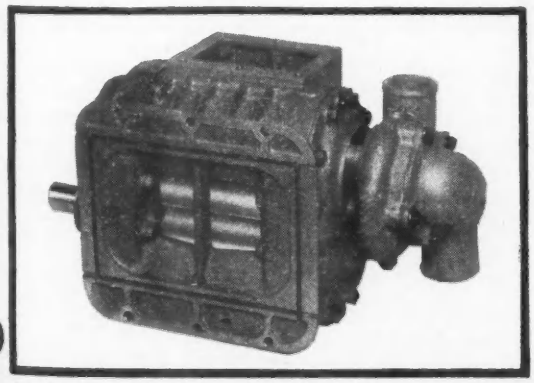


HY-DUTY cooling fans—6 inches to 8 feet—there is one for ALL sizes internal combustion engines. (Illustration) 81 inch diameter Hy-Duty fan on jacket water cooler.



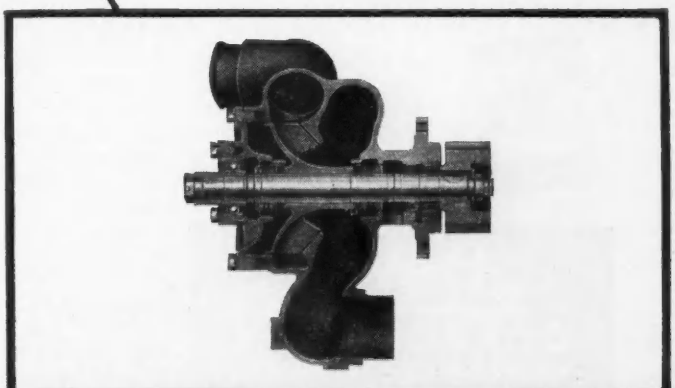
● ***We offer a complete water pump service, embracing an entire pump, a fine impeller, or a superior automatic shaft seal.***

Torsional vibration dampers of friction and flexible rubber mounted types for gasoline or Diesel engines up to 500 HP.



Schwitzer-Cummins Superchargers, centrifugal and positive displacement, are built to our design or customer's requirements in a range of sizes to supercharge engines 50 HP to 500 HP rating, pressure ratios of 2 to 1 maximum, with drives to suit the application.

(Illustration). Supercharger-water pump combination for six cylinder, two cycle Diesel engine.



Oil Pumps—circulating and scavenging—Water Pumps—Low or high pressure requirements—for all types cooling fluids.

(Cutaway view) Water Pump for 280 HP Diesel engine showing bearing and automatic shaft seal construction.

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"Automatic Shaft Seals—a Schwitzer-Cummins Development"

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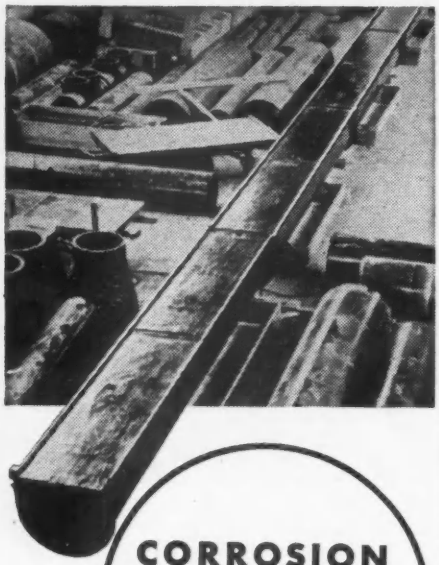

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Corrosion eats into profits by eating into equipment—resulting in heavy maintenance and replacement costs.

Reduce that expense by using HAVEG for process equipment wherever possible — for tanks, towers, coolers, piping, valves, pumps, fume ducts and similar applications.

HAVEG is a molded structural material resistant to chemical action throughout its entire mass. *It is not a lining or coating* to become ineffective when damaged by surface abrasions or scratches.

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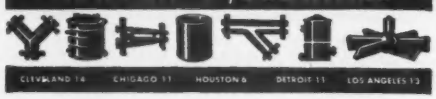


CLEVELAND 14 · CHICAGO 11 · HOUSTON 6 · DETROIT 11 · LOS ANGELES 13

General News

(*Continued from page* 94)

Douglas Proposes DC-9 As Successor to DC-3

A successor to the DC-3, the DC-9, a new two-engined commercial transport, has been proposed by Douglas Aircraft Co., Inc. A conventional low-winged monoplane, slightly larger than the DC-3, the new plane has retractable tricycle landing gear, and two 1475 hp Wright Cyclone R-1820 engines. A cruising speed of 257 mph; an absolute range of over 2400 mi; a span of 101 ft; overall length of 70 ft, 8 in.; a height of 26 ft; a gross weight of 30,000 lb; and capacity for 28 passengers are reported. Douglas emphasizes that this is a proposal only, and that production is contingent upon acceptance by the airlines.

North American Simulates Supersonic Shock Waves

By towing a model through a water channel, North American Aviation, Inc., can simulate the supersonic shock wave system created by high speed airplanes and pilotless missiles. By towing models representing supersonic wings, ram jets or similar components through a water channel one quarter of an inch deep, speeds up to 7000 mph can be simulated, it is claimed. A wheeled stand holding a camera records the patterns of shock waves. The models being towed through the shallow channel create water wave patterns which are similar in shape to the shock waves sent out by a body flying through the air at supersonic speeds.

Two AMA Officials Delegates To Metal Trades Conference

George Romney, managing director of AMA, and William J. Cronin, secretary of AMA Manufacturers' Committee, are enroute to Stockholm, Sweden, as two of the American industrial delegates to the Second Metal Trades Conference of the International Labor Office, Sept. 3-13. While in Europe, Mr. Romney will investigate the automobile industries of northern Europe and England for any developments of interest to the American automobile industry. Purpose of the Metal Trades Conference is to bring together labor, industry, and government representatives of the world's principal metal working nations to exchange information, points of view, and suggestions for maximum production and employment in the metal trades industries.

(*Turn to page* 100, *please*)

"SOLVOL increased carbide drill life more than 150%..."

...says J. P. TOMLINSON, D. A. Stuart Oil Co. Representative

this is the story...

"Using a competitive soluble oil, this manufacturer was getting from twenty to twenty-five holes per carbide drill, being used on angular crankshaft oil holes. The drills in many cases were seizing and flaking as they became dull. Production rate was very slow and cost per crankshaft much higher than they had anticipated. SOLVOL LIQUID CUTTING COMPOUND was put on the job at a twenty to one dilution. Drill life immediately increased to sixty-five holes per drill. Flaking was eliminated entirely. The production rate accordingly increased with reduction of crankshaft machining costs."

J. P. Tomlinson

This actual performance report from Stuart's files provides additional proof that the *right* cutting fluid can make the difference between profit and loss on many metal-cutting operations. Put an experienced Stuart engineer to work on *your* cutting problems... his service, supported by complete specialized laboratory facilities, is available for the asking.

STUART *service goes with every barrel*

WRITE FOR DETAILS

D. A. Stuart Oil Co.
EST. 1865 LIMITED

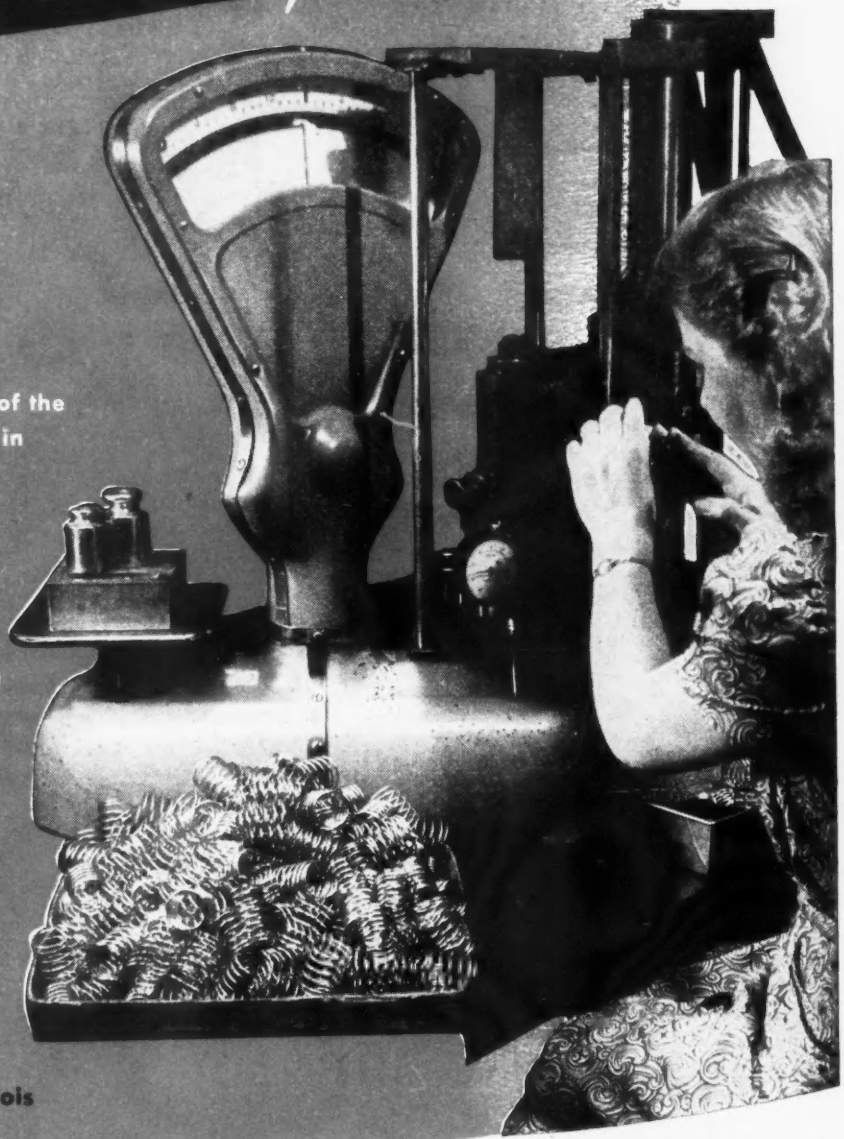
2733 SOUTH TROY STREET, CHICAGO 23, ILL.

the uniformity of Accurate Springs

means lower ultimate cost FOR YOU!

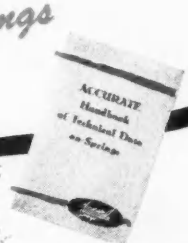
Ordinarily you don't speak of the uniformity of a batch of springs in the same breath with cost. But the two are really inseparable . . . variations in the size and shape of springs can cause the loss of dollars worth of assembly time . . . variations in load characteristics can result in unsatisfactory operation of the finished product.

Here at Accurate you'll find skilled springmakers and practical, experienced engineers . . . people who realize the importance of uniformity to you. Why not make it a point to discuss your spring problems with us. **ACCURATE SPRING MFG. CO., 3810 W. Lake Street, Chicago 24, Illinois**



Load testing is one of several controls exercised at Accurate.

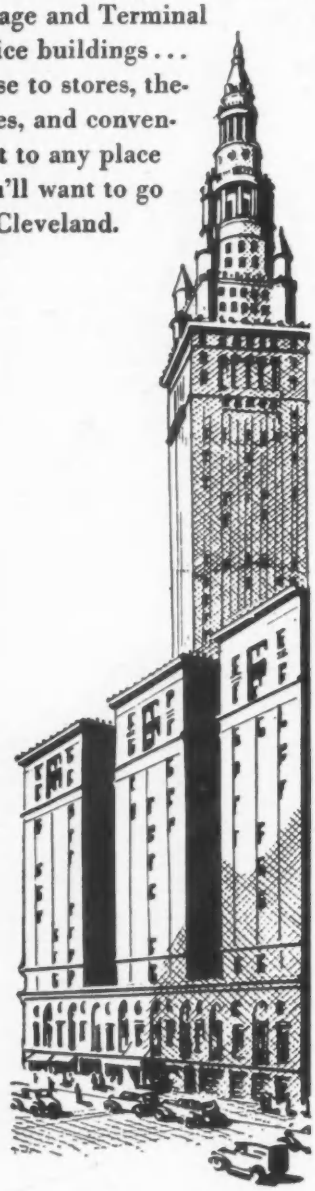
Springs — Accurate Springs — Wire Forms • Stampings



Send for your copy of the new Accurate Spring Handbook. It's full of data and formulae which you will find useful. No obligation of course.

A warm and friendly welcome . . .

a quiet, comfortable, sleep-inviting room . . . right in the heart of downtown Cleveland. Hotel Cleveland adjoins Union Passenger Terminal, garage and Terminal office buildings . . . close to stores, theatres, and convenient to any place you'll want to go in Cleveland.



HOTEL CLEVELAND

Cleveland, Ohio

General News

(*Continued from page* 96)

Lockheed Gets $2.5 Million Contract for 32 P-80B Jets

A contract totaling $2.5 million for 32 new P-80B's has been awarded by the Army Air Forces to the Lockheed Aircraft Corp. Featuring six machine guns in the nose, the P-80B "Shooting Star" is a jet propelled fighter in which water injection has been employed in the turbo-jet engine to increase take-off and climb. Enclosed radio masts, air conditioning in the pressurized cockpit, a pilot ejector seat, strengthened bulkheads and a thickened skin are among other features.

GM Opens Warehouses in Baltimore and Scranton

Two new warehouses in Baltimore and Scranton, Pa., were recently opened by General Motors Corp. for Chevrolet, Pontiac and Oldsmobile parts and accessories. Stocking over 23,000 parts and accessories, the Baltimore warehouse covers 104,000 sq ft. The Scranton warehouse stocks almost 12,000 parts and accessories and covers 30,000 sq ft.

Pratt & Whitney Gets $1.5 Reconversion Order

The Pratt & Whitney Aircraft Div. of United Aircraft Corp. will receive over $1.5 million for converting and overhauling 72 Wasp Major engines for the AAF. The AAF will save about $4 million by overhauling the engines rather than by buying new engines. When the project is completed, the engines will develop 3500 hp, as compared with a present rating of 3000 hp.

Ford Produces Glass and Panel Board

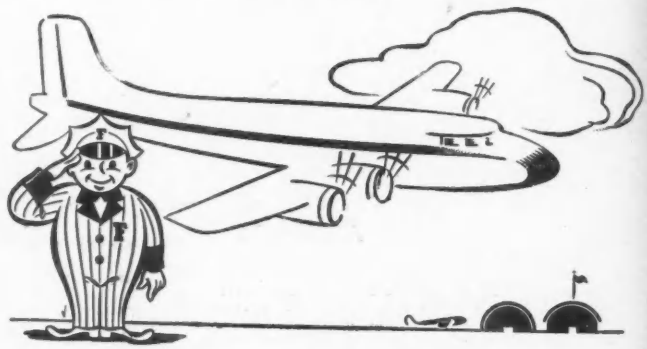
The Ford Motor Co. has resumed production of plate glass at the Rouge plant. For the balance of the year, the total production will be ⅛ in. plate glass, laminated for Ford car and truck windshields. An addition to the Rouge paper mill is now being built for the production of automobile panel board by the continuous process method.

Classified Advertisement

FOR SALE: 900—Remy #1902104 12 volt field coils from Delco Remy Generators #1101747. 900—Remy #5897 12 volt regulator for Delco Remy Generator #1101747. General Armature & Manufacturing Co., Lock Haven, Pa.

AUTOMOTIVE INDUSTRIES Goes into Leading Plants in the Automotive and Aircraft Industries

A Smooth Take-Off . . . . .
A Happy Landing . . . . .



Seal your "air power" with Fitzgerald gaskets—a famous and dependable name in gaskets the world over.

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